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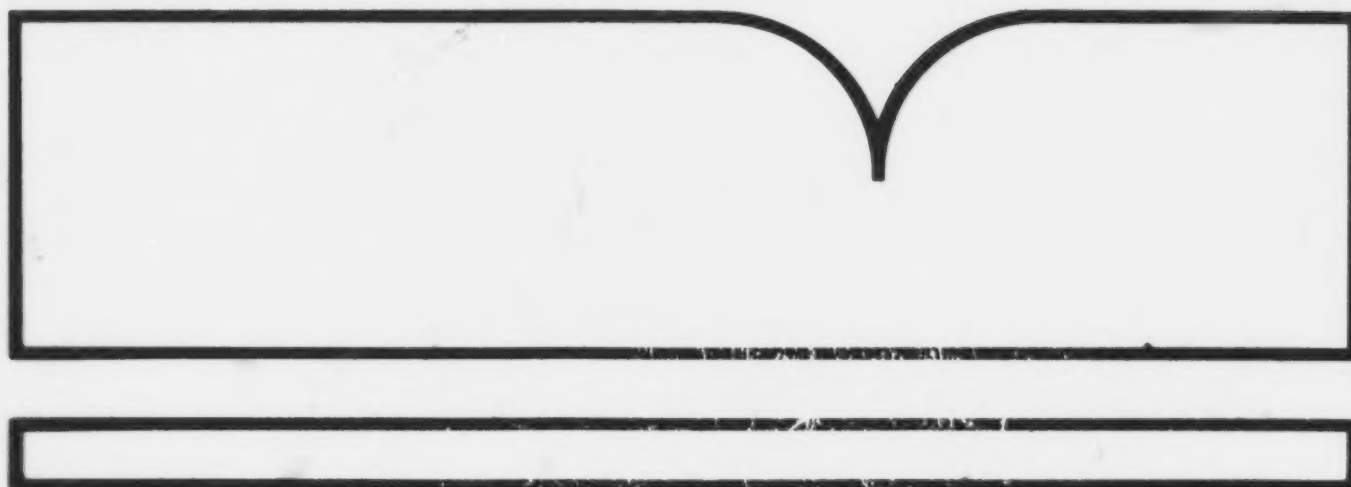
Environmental Regulations and Technology
The Electroplating Industry

Centec Corp.
Reston, VA

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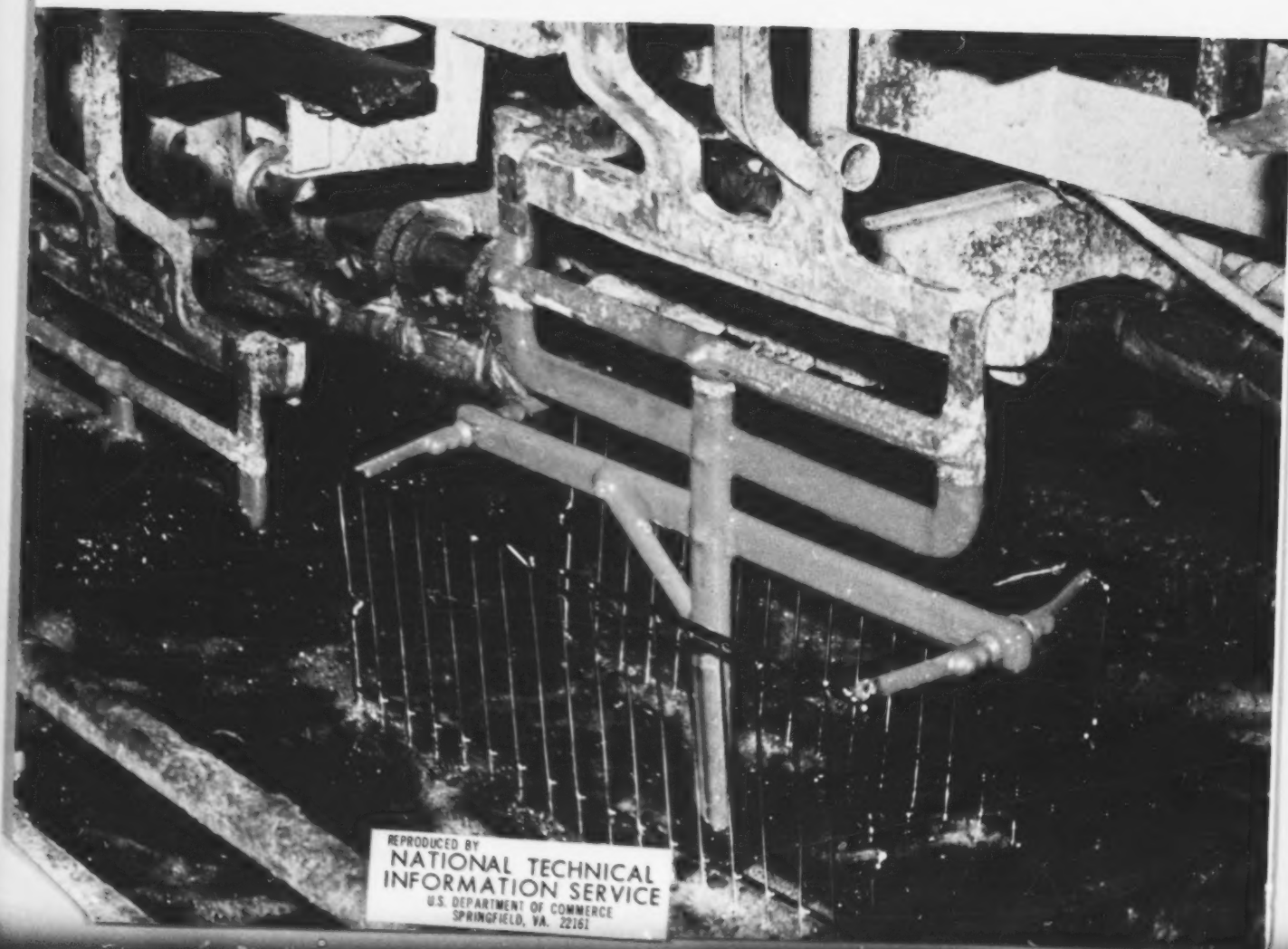
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Technology Transfer



Environmental Regulations and Technology

The Electroplating Industry



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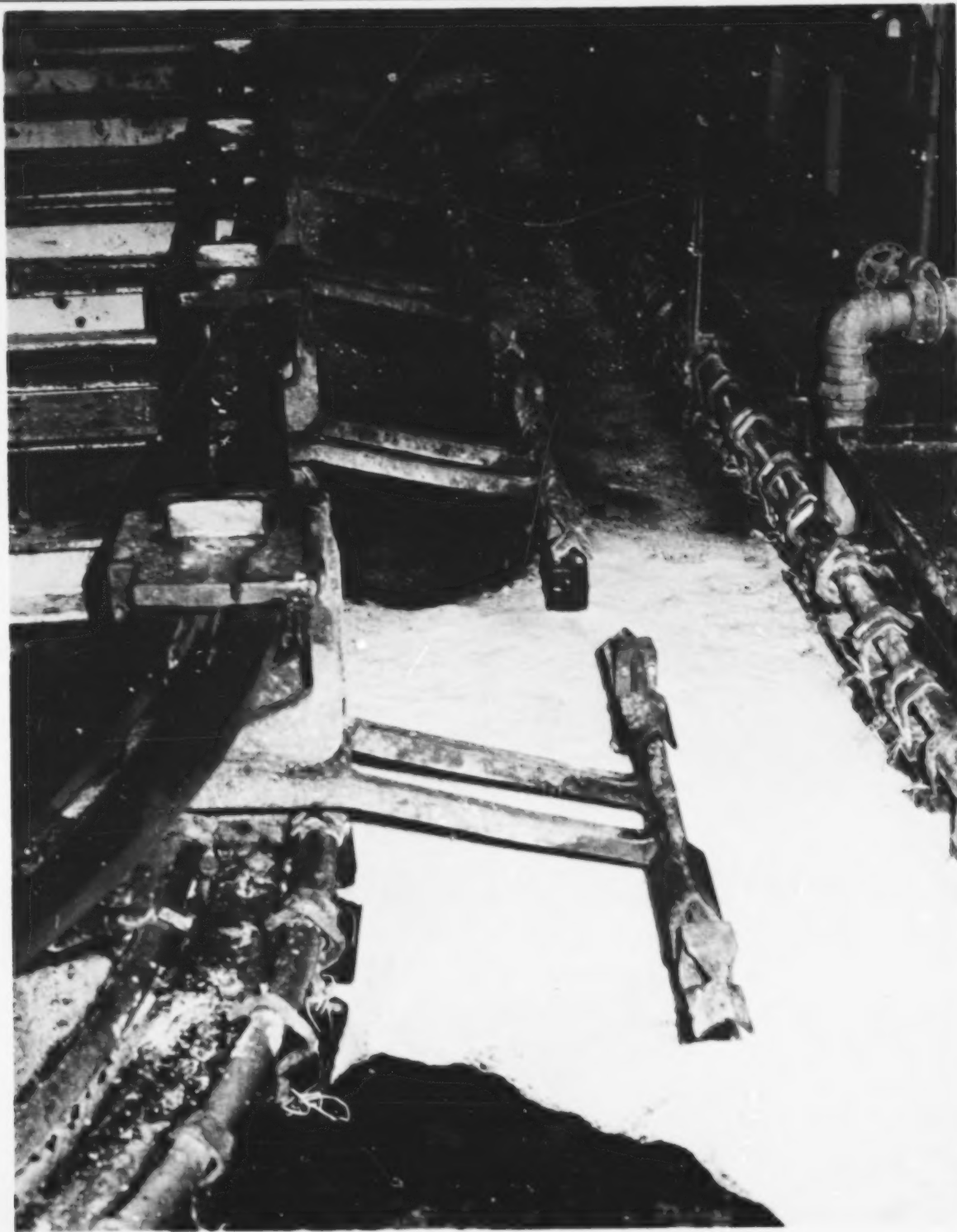
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16. ABSTRACT This report is intended to provide the electroplating industry with a summary of the laws and EPA regulatory activities, and of regulations and technologies that can affect electroplaters' decisions for wastewater pollution control and solid waste handling and disposal. The regulations promulgated by EPA are presented and water pollution control technologies and case histories of installations are discussed. Processes are described only to provide some guidance for selecting pollution control systems. The report also includes information on the status of sludge disposal regulations, technologies and operating techniques that can reduce sludge disposal costs, and financial assistance available through federally sponsored programs. For industries discharging wastewater to waterways (direct dischargers), the most far-reaching feature of the 1972 FWPCA amendments was the requirement that all such industries install a base level of pollution control technology by July 1, 1977, and a more stringent level by July 1, 1983 (later amended to 1984). The base level was called Best Practicable Control Technology Currently Available (BPCTCA), or simply BPT. The more stringent level was termed the Best Available Technology Economically Achievable (BATEA), and is usually referred to as BAT. In addition, special standards known as New Source Performance Standards (NSPS) were to be established for new plants.		
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The Electroplating Industry

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Nickel plating bath

Contents

1. Overview	1
2. Water Pollution Control Regulations	2
The Clean Water Act.	3
Applications to Electroplaters Discharging Directly to Waterways.	5
National Pretreatment Standards for Indirect Dischargers	6
General Pretreatment Regulations	6
Important Aspects for Electroplaters	7
Variance Application	7
Removal Allowances	8
Specific Pretreatment Standards for Electroplaters.	9
3. Water Pollution Control Technologies	11
Selecting a System	11
Resource Recovery and Pollutant Load Reduction Modifications	12
Conventional Wastewater Treatment	13
Alternative Methods of Treatment	14
Cost Implications of Direct Wastewater Discharge	15
4. Water Pollution Control Case Histories	16
Case History 1. Economic Evaluation of Evaporator Installation ...	16
Case History 2. Automated Direct Drag-out Recovery	18
Case History 3. Stream Segregation to Enhance Conventional Treatment System Performance	19
Case History 4. Sulfide Precipitation	20
Case History 5. Ion Exchange for Selective Heavy Metal Removal ...	22
5. Solid Waste Management	25
Hazardous Waste Regulations	25
Identification of Hazardous Wastes	25
Requirements for Hazardous Waste Generators	27
Requirements for Storage and Disposal Facilities	28
Reduction of Sludge Volume and Disposal Cost	29
Effects of Pollutant and Wastewater Load Reduction	30
Effects of Treatment Techniques	30
Effects of Sludge Dewatering	31
6. Financing Alternatives	35
Income Tax Provisions	35
Small Business Administration Loans	35
SBA-Guaranteed Pollution Control Revenue Bonds	35
Other Sources	36
7. Consolidated Permit Program	37
8. Contacts	38
Regulatory Information	38
Financial Assistance Information	38
EPA Regional Offices	39
References	41

Illustrations

Figures

1. Electroplating Industry Conventional Wastewater Treatment	13
2. Annual Sewer Fee as a Function of Flowrate	15
3. Evaporative Recovery System: (a) Closed-Loop and (b) Open-Loop. . .	17
4. Cost Versus Feed Rate for Open-Loop Evaporator System	18
5. Automated Direct Drag-out Recovery	18
6. Percentage of Drag-out Recovery with Rinse-and-Recycle System. . .	19
7. Treatment System With Waste Stream Segregation	20
8. Treatment System With Sulfide Precipitation	21
9. Continuous Treatment System	23
10. Generator Obligations Under the Resource Conservation and Recovery Act	27
11. Annual Cost for Sludge Disposal	29
12. Sludge Generation Rates for Three Treatment Systems.	30
13. Sludge Volume Versus Solids Concentration	31
14. Recessed Plate Filter Press and Auxiliary Equipment Needed for Sludge Dewatering	32
15. Annual Sludge Disposal Cost for Filter Press Dewatering System	33
16. Return on Investment from Recessed Plate Filter Installation.	34

Tables

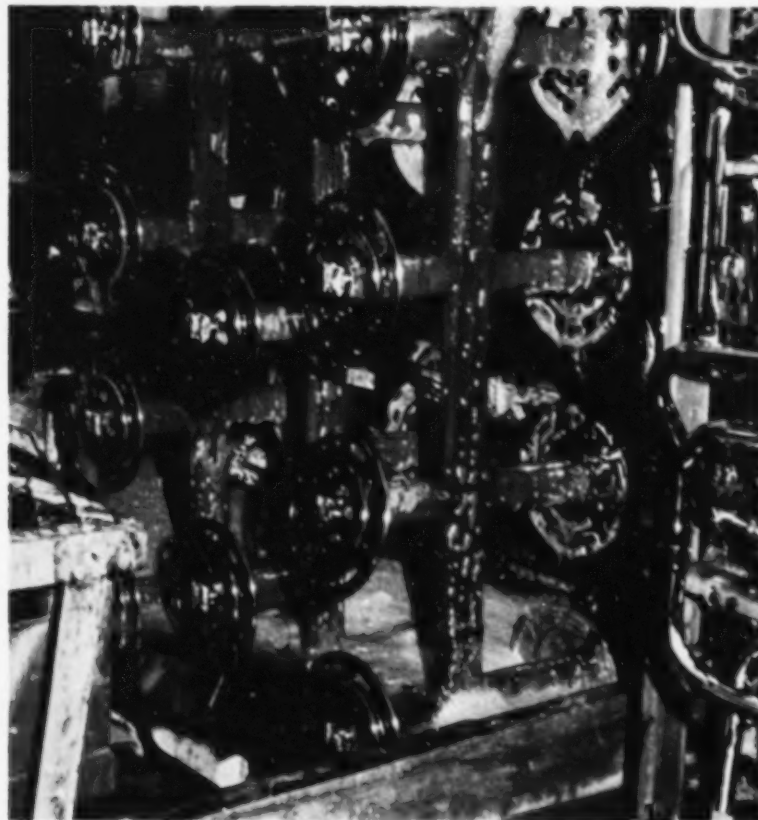
1. Summary of Legislative Activities	3
2. Best Practicable Control Technology Currently Available Effluent Limitations (Suspended Indefinitely): Subparts A and D-F.	4
3. Best Practicable Control Technology Currently Available Effluent Limitations (Suspended Indefinitely): Subpart B.	5
4. Best Practicable Control Technology Currently Available Effluent Limitations (Suspended Indefinitely): Subparts A, B, and D-F.	6
5. EPA Classification of Electroplating Industry.	6
6. Pretreatment Standards for Existing Sources: Subparts A, B, and D-H.	8
7. Pretreatment Standards for Existing Sources: Alternative 1—Subparts A, B, and D-H	9
8. Pretreatment Standards for Existing Sources: Alternative 2—Subparts A, B, and D-H	10
9. Economic Evaluation for Evaporator Installation.	16
10. Permit Requirements and Treated Effluent Quality: Waste Stream Segregation	20
11. State Requirements and Treated Effluent Quality: Sulfide Precipitation	22
12. Permit Requirements and Treated Effluent Quality: Ion Exchange. . . .	24
13. Toxic Waste Limits Set by EPA's Extraction Procedure	26

1. Overview

The enactment of a series of laws by the U.S. Congress has confronted the electroplating industry with a multitude of pollution control requirements for wastewater and solid residues. The Congress assigned the U.S. Environmental Protection Agency (EPA) the responsibility for preparing the detailed regulations and establishing the administrative procedures for carrying out the laws.

Because the water pollution and solid waste laws were passed at different times, EPA's schedule for implementing pollution control requirements differs for each of these areas. Therefore, electroplaters must keep informed of new and changing regulations, as integrated compliance will reduce pollution control and treatment costs.

This report is intended to provide the electroplating industry with a summary of the laws and EPA regulatory activities, and of regulations and technologies that can affect electroplaters' decisions for wastewater pollution control and solid waste handling and disposal. The regulations recently promulgated by EPA are presented and water pollution control technologies and case histories of installations are discussed. Processes are described only to provide some guidance for selecting pollution control systems. The report also includes information on the current status of sludge disposal regulations, technologies and operating techniques that can reduce sludge disposal costs, and financial assistance available through federally sponsored programs.



Chrome plating bath

2. Water Pollution Control Regulations

The regulations to be applied to electroplaters result from a complex series of events, involving an extensive effort by both the government and the electroplating industry. Many platers have been confused by the complexity of the regulatory process, and their confusion is understandable. It is hoped that this section will clarify the essential features of the regulations.

Table 1 summarizes environmental legislative activities that have dealt with water pollution control. With the enactment of the Federal Water Pollution Control Act (FWPCA) as amended in 1972 (Public Law 92-500), the Federal Government became responsible for a wide range of regulations related to water pollution control. Although the average manufacturer may not be concerned with the full scope of this complex bill, of key importance are those parts of the law relating to the discharge of industrial wastewater to waterways^a or municipal systems.

For industries discharging wastewater to waterways (direct dischargers), the most far-reaching feature of the 1972 FWPCA amendments was the requirement that all such industries install a base level of pollution control technology by July 1, 1977, and a more stringent level by July 1, 1983 (later amended to 1984). The base level was called Best Practicable Control Technology Currently Available (BPCTCA), or simply BPT. The more stringent level was termed the Best Available Technology Economically Achievable (BATEA), and is usually referred to as BAT. In addition, special standards known as New Source Performance Standards (NSPS) were to be established for new plants.

Although the BPT and BAT standards were intended for national compliance, regardless of location, they are actually minimum standards. If the BPT pollution control techniques applied by all sources discharging to waterways are inadequate to meet the established water quality standards for a stream, both EPA and the State are required to impose even stricter pollution control requirements. In all cases, the State is authorized to impose requirements more stringent than the Federal guidelines.

The National Resources Defense Council (NRDC) et al. sued EPA for not fulfilling its obligation under the 1972 FWPCA amendments, and in 1976 EPA agreed to concentrate attention on potentially toxic substances using technology-based standards. The agreement, called the NRDC Consent Decree or the Settlement Agreement, required as much control of toxic pollutants as technologically feasible by including toxic substances in the standards to be issued for individual industries.

The NRDC Consent Decree committed EPA to a schedule for developing BAT effluent limits for 21 major industries—including electroplating—covering 65 recognized classes of toxic substances. EPA has further classified these 65 categories into 129 specific substances.

In 1977 the provisions of the NRDC Consent Decree and other changes were incorporated in further amendments to the FWPCA. These amendments, known as the Clean Water Act of 1977 (Public Law 95-217), included increased emphasis on the control of toxic pollutants and specific provisions for the control of industrial wastes discharged to publicly owned treatment works (POTW's). (Plants discharging into POTW's are often referred to as indirect dischargers.)

^aThe language of the legislation refers to "discharge to navigable waters."

Table 1.**Summary of Legislative Activities**

Year	Legislation	Effect
1972.....	Federal Water Pollution Control Act (FWPCA) Amendments (Public Law 92-500)	Required all industries discharging waste into waterways and municipal systems to install a base level of pollution control technology (BPT) by July 1, 1977. Required BAT by 1983 (later revised to 1984—see Clean Water Act). Required new source performance standards. Established National Pollutant Discharge Elimination System permit program. Required self-monitoring by plants discharging to navigable waters. Established Federal control over municipal treatment plants. Electroplating regulations were proposed under the act, but were suspended shortly thereafter.
1976.....	National Resource Defense Council (NRDC) Consent Decree (NRDC et al. vs. Train)	Committed EPA to schedule for developing BAT effluent limitations for 21 major industries covering 65 recognized toxic substance classes (129 specific compounds). The Clean Water Act incorporated these parameters.
	Resource Conservation and Recovery Act (Public Law 94-580)	Established controls for disposal of all solid wastes. Defined hazardous solid wastes. Established tests to determine if waste is hazardous. Established standards for solid waste generators, storage facilities, and disposal sites. Required manifest system for transportation of hazardous wastes. Regulations under the act were promulgated on May 19, 1980.
1977.....	Clean Water Act (Public Law 92-217)	Amended FWPCA. Revised deadlines established under FWPCA. Defined classes of pollutants as toxic, conventional, and nonconventional. Placed major emphasis on the toxic compounds associated with the NRDC Consent Decree. Linked pretreatment standards to BAT guidelines for toxics. Authorized publicly owned treatment works to relax pretreatment standards under certain conditions. Placed 1-year moratorium on industrial cost recovery. Most electroplating regulations were promulgated under the act on September 7, 1979. The rest are scheduled for mid-1981.
	Toxic Substances Control Act (Public Law 94-469)	Can require extensive testing of chemicals by manufacturers. Can require premarket notification to EPA of all new chemicals or mixtures. Can require maintenance of records. Can delay manufacture or marketing of new chemical products pending generation of sufficient environmental information. Can ban or restrict chemical marketing.

Note.—Earlier legislation included: 1956, Federal Water Pollution Control Act; 1965, Water Quality Act; 1966, Clean Water Restoration Act; 1970, Water Quality Improvement Act.

The Clean Water Act

The goals of the Clean Water Act of 1977 were identical to those originally defined in the 1972 FWPCA amendments, which called for:

- Eliminating the discharge of pollutants to waterways by 1985
- Providing for fishable, swimmable waters by 1983
- Eliminating the hazards of toxic compounds

The three levels of control—BPT, BAT, and NSPS—were retained, but

many changes were made. For example, the Clean Water Act:

- Defined three classes of pollutants—toxic, conventional, and nonconventional.
- Revised deadlines.
- Required EPA to address the 65 classes of pollutants (129 specific substances) for both direct and indirect dischargers.
- Authorized POTW's to relax pretreatment standards if it could be shown that no detrimental effects on the POTW's treatment levels would result.

The Clean Water Act identifies the same 65 compounds that were associated with the NRDC Consent Decree. These toxic pollutants

are subject to effluent limits that result from applying BAT regulations. BAT is to be installed no later than July 1, 1984, by industries directly discharging to waterways. For all other toxic substances subsequently added to the list, plants must comply with BAT limits no later than 3 years after the limit is established. Regulations, or effluent limits, for direct dischargers are expected to be determined by EPA during 1980 to allow industries time to install the appropriate technologies; however, it is unlikely that the BAT regulations for electroplating will be promulgated before mid-1981.

Table 2.

Best Practicable Control Technology Currently Available Effluent Limitations^a (Suspended Indefinitely^b): Subparts A and D-F^c

Effluent characteristic	Effluent limits							
	Subpart A		Subpart D		Subpart E		Subpart F	
	Daily maximum	30-d average	Daily maximum	30-d average	Daily maximum	30-d average	Daily maximum	30-d average
Pollutant (lb/10 ⁶ ft ² /operation):								
Copper.....	32.7	16.4	18.4	9.2	16.4	8.2	24.6	12.3
Nickel.....	32.7	16.4	18.4	9.2	16.4	8.2	24.6	12.3
Chromium:								
Total.....	32.7	16.4	18.4	9.2	16.4	8.2	24.6	12.3
Cr ⁺⁶	3.3	1.6	1.8	0.9	1.6	0.82	2.4	1.2
Zinc.....	32.7	16.4	18.4	9.2	16.4	8.2	24.6	12.3
Cyanide:								
Total.....	32.7	16.4	18.4	9.2	16.4	8.2	24.6	12.3
Amenable.....	3.3	1.6	1.8	0.9	1.6	0.82	3.8	1.9
Fluoride.....	1,308	654	738	369	646	323	984	492
Cadmium.....	19.2	9.6	8.8	4.4	9.8	4.9	14.8	7.4
Lead.....	32.7	16.4	(^d)	(^d)	(^d)	(^d)	(^d)	(^d)
Iron.....	65.4	32.7	36.8	18.4	32.8	16.4	49.2	24.6
Tin.....	65.4	32.7	36.8	18.4	32.8	16.4	49.2	24.6
Phosphorus.....	65.4	32.7	36.8	18.4	32.8	16.4	49.2	24.6
Total suspended solids.....	1,308	654	738	369	646	323	984	492
pH.....	6.0-9.5	6.0-9.5	6.0-9.5	6.0-9.5	6.0-9.5	6.0-9.5	6.0-9.5	6.0-9.5

^aPlants employing more than 11 persons, discharging more than 2,061 gal/h from metal finishing processes, or having a production rate greater than 52.7 ft²/h per employee.

^bAlthough these regulations were suspended and are not in effect, they may be used by permit writers as guidance.

^cDescribed in Table 5.

^dNot applicable.

SOURCES: U.S. Environmental Protection Agency, "Effluent Guidelines and Standards: Electroplating Point Source Category, Pretreatment Standards for Existing Sources," *Federal Register* 44(175):52590-52629, Sept. 7, 1979. U.S. Environmental Protection Agency, "Effluent Guidelines and Standards, Electroplating Point Source Category, Pretreatment Standards for Existing Sources," *Federal Register* 44(191):56330-56333, Oct. 1, 1979. U.S. Environmental Protection Agency, "Effluent Guidelines and Standards, Electroplating Point Source Category, Pretreatment Standards for Existing Sources; Correction," *Federal Register* 45(59):19245-19246, Mar. 25, 1980.

The control of pollutants defined as conventional beyond BPT was made subject to a cost-to-benefit analysis to determine if any additional reduction was warranted. The conventional pollutants are biochemical oxygen demand (BOD), total suspended solids (TSS), oil and grease, and pH. This part of the law reflected Congress' feeling that BPT might be sufficient for these pollutants.

Nonconventional pollutants are all pollutants that are neither conventional nor toxic.

Another change from the 1972 FWPCA amendments is the innovative technology extension

covered in Section 301(k) of the Clean Water Act. Congress, wishing to encourage wastewater reuse and recycling as well as other innovations, provided an opportunity for temporary relief from some guidelines to facilities interested in pursuing innovative control techniques. Thus, Section 301(k) permits an extension of the BAT requirements for both direct and indirect discharging industrial sources using innovative technologies. The extension can be granted until July 1, 1987, if the technology will achieve significantly greater effluent reduction than BAT at a similar cost, or if it will allow compliance

with existing requirements at significantly reduced costs. In either case, the system must have potential for industrywide application. Guidelines governing the extension, although not yet established, will include the application mechanism and general requirements for identifying when a technology is considered innovative.

The National Pollutant Discharge Elimination System (NPDES) permit has been the heart of the regulation and enforcement system since the passage of the 1972 FWPCA amendments, and it continues in that role under the Clean Water Act. Under NPDES provisions, each point source discharging into a waterway must

apply for a permit either through the State (if the State has an EPA-approved permit program) or through EPA. A manufacturer or municipality must obtain a permit detailing the pollutants that may be discharged, a schedule for compliance, monitoring and reporting requirements, and the period (not to exceed 5 years) for which the permit applies.

The Federal Government has authority to ensure compliance with the conditions of the permit. If violations of State-issued permits are not followed by appropriate enforcement action, EPA can initiate its own action after 30 days' notice. The law further states that any person who willfully or negligently violates any permit condition shall be punished by a fine of not more than \$25,000, by imprisonment for not more than 6 months, or by both. In this case, "person" is interpreted to mean any responsible corporate officer.

To provide regulatory officials with sufficient information for establishing effluent standards, and to maintain information on the amounts of pollutants being discharged, the law allows EPA to require that a manufacturing facility monitor its own wastes in a manner to be specified by EPA. The manufacturer must keep adequate records, to be provided to EPA on request or on an established schedule. Self-monitoring plays an important part in the implementation of controls on manufacturers.

EPA also has the right, on presentation of appropriate credentials, to visit any manufacturing site, to examine records, to check sampling and monitoring equipment, and to take any samples required for checking the results submitted by the manufacturer. The information gathered becomes public, unless trade secrets or proprietary information would be revealed in the process. In cases of this kind, provisions are made to allow access only to regula-

Table 3.

Best Practicable Control Technology Currently Available Effluent Limitations^a (Suspended Indefinitely^b): Subpart B^c

Effluent characteristic	Effluent limits	
	Daily	30-d average
Pollutant (lb/10 ³ ft ² /operation):		
Silver.....	3.3	1.8
Gold.....	3.3	1.8
Cyanide:		
Total.....	3.3	1.8
Amenable.....	32.7	18.4
Chromium:		
Total.....	32.7	18.4
Cr ^{VI}	3.3	1.8
Indium.....	3.3	1.8
Osmium.....	3.3	1.8
Palladium.....	3.3	1.8
Platinum.....	3.3	1.8
Rhodium.....	3.3	1.8
Ruthenium.....	3.3	1.8
Phosphorus.....	65.4	32.7
Total suspended solids.....	1,308	654
pH.....	6.0-9.5	6.0-9.5

^aPlants employing more than 11 persons, discharging more than 2,061 gal/h from metal finishing processes, or having a production rate greater than 52.7 ft²/h per employee.

^bAlthough these regulations were suspended and are not in effect, they may be used by permit writers as guidance.

^cDescribed in Table 5.

SOURCES: U.S. Environmental Protection Agency, "Effluent Guidelines and Standards: Electroplating Point Source Category: Pretreatment Standards for Existing Sources," *Federal Register* 44(175):52590-52629, Sept. 7, 1979; U.S. Environmental Protection Agency, "Effluent Guidelines and Standards, Electroplating Point Source Category: Pretreatment Standards for Existing Sources," *Federal Register* 44(191):56330-56333, Oct. 1, 1979; U.S. Environmental Protection Agency, "Effluent Guidelines and Standards, Electroplating Point Source Category: Pretreatment Standards for Existing Sources; Correction," *Federal Register* 45(59):19245-19246, Mar. 25, 1980.

tory officials. (By law, however, effluent data cannot be considered proprietary.) Several State and local governments also have many of the foregoing authorities.

Applications to Electroplaters Discharging Directly to Waterways

The pretreatment regulations published on September 7, 1979,¹ included effluent guidelines representing EPA's best estimate of BPT for direct dischargers, but footnotes to the relevant sections indicated that these regulations have been suspended indefinitely. The published BPT values (Tables 2

through 4), therefore, are not enforceable until EPA repromulgates the direct discharge sections.

Lacking national regulations for direct dischargers, permit writers will use their own best judgment in issuing permits to plants in the industry subparts¹ shown in Table 5. Many permit writers, however, will use one of the following as guidance:

- The national pretreatment standards for indirect dischargers (discussed in the next subsection)
- The suspended BPT regulations (Tables 2 through 4)

BAT regulations are in preparation, but are not expected to be promulgated until 1981.

Table 4.

Best Practicable Control Technology Currently Available Effluent Limitations^a
(Suspended Indefinitely^b): Subparts A, B, and D-F^c

Effluent characteristic	Effluent limits					
	Subparts A and B		Subparts D and F		Subpart E	
	Daily maximum	30-d average	Daily maximum	30-d average	Daily maximum	30-d average
Cyanide (lb/10 ⁶ ft ² /operation):						
Amenable, . . .	3.3	1.6	1.8	0.92	1.6	0.82
Total, ...	32.7	16.4	18.4	9.2	16.4	8.2
Flow, ...	← Equalize →					
pH, ...	6.0-9.0	6.0-9.0	6.0-9.0	6.0-9.0	6.0-9.0	6.0-9.0

^aPlants employing less than 11 persons, discharging less than 2,061 gal/h from metal finishing processes, or having a production rate less than 52.7 ft²/h per employee.

^bAlthough these regulations were suspended and are not in effect, they may be used by permit writers as guidance.

^cDescribed in Table 5.

SOURCES: U.S. Environmental Protection Agency, "Effluent Guidelines and Standards; Electroplating Point Source Category; Pretreatment Standards for Existing Sources," *Federal Register* 44(175):52590-52629, Sept. 7, 1979. U.S. Environmental Protection Agency, "Effluent Guidelines and Standards, Electroplating Point Source Category, Pretreatment Standards for Existing Sources," *Federal Register* 44(191):56330-56333, Oct. 1, 1979. U.S. Environmental Protection Agency, "Effluent Guidelines and Standards, Electroplating Point Source Category, Pretreatment Standards for Existing Sources; Corrections," *Federal Register* 45(59):19245-19246, Mar. 25, 1980.

Table 5.

EPA Classification of Electroplating Industry

Subpart	Description
A	Electroplating of common metals (Al, Cd, Cu, Cr, Fe, Ni, Sn, Pb, Zn, and any combination)
B	Electroplating of precious metals (Au, In, Pt, Rh, and Ag)
C	Electroplating of specialty metals
D	Anodizing (anodizing, acid cleaning, and alkaline cleaning)
E	Coatings (coloring, chromating, phosphating, stripping, immersion plating, acid cleaning, and alkaline cleaning)
F	Chemical etching and milling (chemical milling, etching, bright dipping, acid cleaning, and alkaline cleaning)
G	Electroless plating
H	Printed circuit board manufacturing

Note.—Subparts A, B, and C may involve stripping, coloring, phosphating, acid cleaning, and alkaline cleaning.

SOURCE: U.S. Environmental Protection Agency, "Effluent Guidelines and Standards; Electroplating Point Source Category; Pretreatment Standards for Existing Sources," *Federal Register* 44(175):52590-52629, Sept. 7, 1979.

National Pretreatment Standards for Indirect Dischargers

The Clean Water Act directed EPA to set pretreatment requirements for untreated industry wastewaters suspected of containing toxic pollutants in significant amounts. EPA was also directed to include provisions for considering the amount of pollutants removed by POTW's. In response to this directive, EPA has issued two sets of regulations that apply to electroplaters:

- **General pretreatment regulations**^{2,3} set forth the general administrative requirements for POTW's, States, and the involved industries. They outline how the regulations will take into account (through removal allowances) pollutants removed by the POTW.
- **Pretreatment standards for electroplaters**^{1,4-6} set specific levels that electroplaters must meet.

General Pretreatment Regulations

General pretreatment regulations apply to all industrial pollutants introduced in any way into a POTW. These regulations were promulgated on June 26, 1978,² went into effect 60 days later, and were modified and clarified on October 29, 1979.³ They were intended to:

- Prevent the introduction into a POTW of pollutants that will interfere with its operation.
- Prevent the introduction into a POTW of pollutants that will pass through or otherwise be incompatible with the treatment works.
- Improve opportunities to recycle and reclaim municipal and industrial wastewaters and sludges.

In this context, inhibition or disruption of a POTW's sewer system, treatment processes, or operations constitutes "interference" if it contributes to a violation of any requirements of the POTW's NPDES permit. The term includes interference with the POTW's ability to dispose of its sewage sludge.

The general pretreatment regulations specify responsibilities to EPA, the States, POTW's, and industrial dischargers to POTW's; they also detail requirements for obtaining removal allowances.

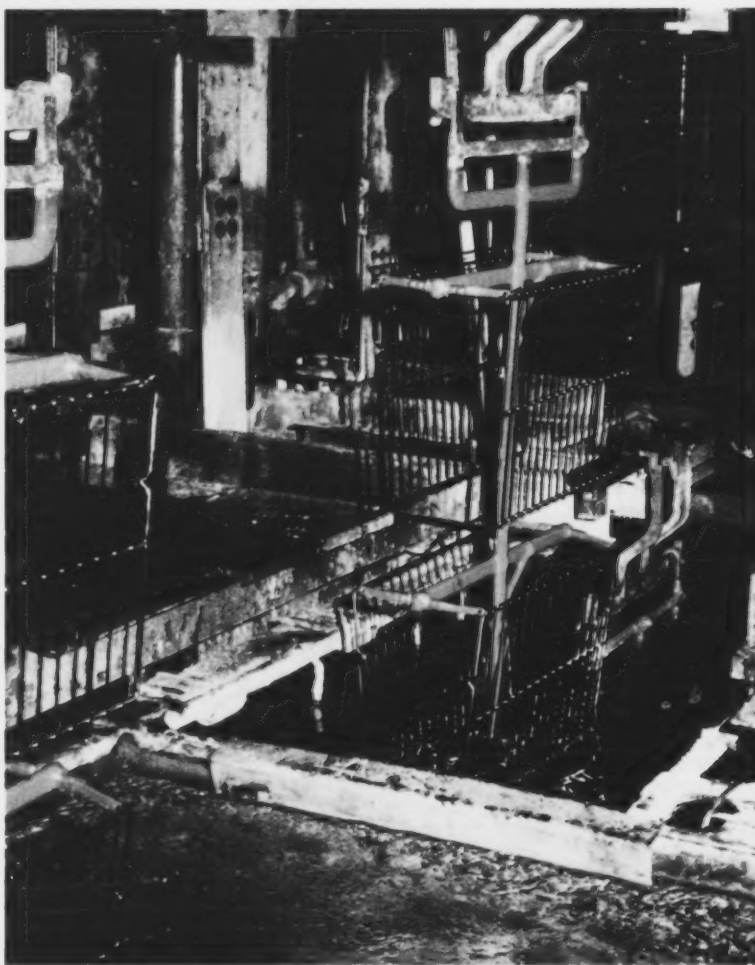
Important Aspects for Electroplaters. Industries discharging to municipalities are required to do one of the following:

- Meet the specific pretreatment limits set by EPA for the industry.
- Obtain a more lenient requirement through a removal allowance, which must be obtained for the industry by the municipality.
- In special cases, where qualified, obtain a "fundamentally different" variance.

The plater who meets the specific pretreatment guidelines for electroplaters need not be concerned with the second or third items.

Variance Application. In some cases, information that may affect an industry's pretreatment standards will not have been considered when the standards were developed. If it is believed that a particular situation is fundamentally different from that considered in developing the standards, a variance may be requested. Requests will be approved only if:

- Factors relating to the industrial user are fundamentally different from those considered by EPA in establishing the standard, and these factors greatly increase cost.
- The factors existed before EPA promulgated the standard.



Rinse for nonbrass metals

A request for a variance and supporting evidence must be submitted in writing to the NPDES State director or to EPA's Enforcement Division Director within 90 days after promulgation. If the request for variance is rejected, there are provisions for appeal to the EPA Administrator; if it is approved, a new discharge limit will be imposed. General pretreat-

ment regulations are expected to be amended by August 1980, after which time the 90-day time limit will apply.

Three aspects of the variance application approach should be stressed:

- Some control will still be required.
- The variance will be given only for a set period of time and must be renewed. Renewal will not be automatic.
- If the variance is denied, the original 3-year time limit for compliance still holds.

Removal Allowances. The removal allowance offers the most likely approach to obtaining relief from the pretreatment requirements. By this mechanism EPA exercises its authority under the Clean Water Act to consider the removal of pollutants by the POTW.

The removal allowance plan states that, under specified conditions, a POTW may revise a plant's discharge limits for a pollutant if it can be shown that the POTW is removing an amount of pollutant equal to the amount of the revision. The revision must be applied for *by the municipality* and basically requires a demonstration, through actual data, that the pollutant is being removed. The concentration limit would be revised by:

$$Y = \frac{x}{1-r}$$

where

Y = revised discharge limit

x = concentration required by specific standards for electroplaters

r = demonstrated removal fraction

For example, if the data show 60 percent POTW removal of a specific pollutant (by the EPA-specified sampling methods), a pollutant with an initial requirement of 2 mg/l would be revised to:

$$\frac{2}{1-0.6} = 5 \text{ mg/l}$$

EPA specifies that the influent and effluent data taken over the municipal treatment system shall be derived from a minimum of 12 samples taken at approximately equal intervals throughout the year. Where composite sampling is appropriate, the time intervals between samples for the composite cannot exceed 2 hours, and the minimum sampling period must be 24 hours. Flow proportioning is required, and the effluent samples must be taken over a time span equal to the time the influent was retained in the municipal system after it was sampled.

Table 6.

Pretreatment Standards for Existing Sources: Subparts A, B, and D-H^a

Pollutant	Pretreatment standard (mg/l)	
	Daily maximum	4-d average
Plants discharging <10,000 gal/d:		
Cyanide, amenable	5.0	2.7
Lead	0.6	0.4
Cadmium	1.2	0.7
Plants discharging >10,000 gal/d (Alternative 1 ^b):		
Cyanide, total	1.9	1.0
Copper	4.5	2.7
Nickel	4.1	2.6
Chromium	7.0	4.0
Zinc	4.2	2.6
Lead	0.6	0.4
Cadmium	1.2	0.7
Silver ^c	1.2	0.7
All metals	10.5	6.8

^aDescribed in Table 5.

^bMass-based standards.

^cApplies only to Subpart B.

SOURCES: U.S. Environmental Protection Agency, "Effluent Guidelines and Standards: Electroplating Point Source Category; Pretreatment Standards for Existing Sources," *Federal Register* 44(175):52590-52629, Sept. 7, 1979. U.S. Environmental Protection Agency, "Effluent Guidelines and Standards, Electroplating Point Source Category, Pretreatment Standards for Existing Sources," *Federal Register* 44(191):56330-56333, Oct. 1, 1979. U.S. Environmental Protection Agency, "Effluent Guidelines and Standards, Electroplating Point Source Category, Pretreatment Standards for Existing Sources; Correction," *Federal Register* 45(59):19245-19246, Mar. 25, 1980. U.S. Environmental Protection Agency, "Electroplating Point Source Category, Effluent Guidelines and Standards, Pretreatment Standards for Existing Sources," *Federal Register*, in preparation, 1980.

When sampling is for pollutants, such as cyanide, that cannot be held for long periods before analysis, grab samples can be used.

Consistent removal (r in the foregoing equation) is to be that level of removal demonstrated by averaging the lowest 50 percent of the removals measured by 12 or more samples. (This requirement is a change from the initial regulations.)

To prevent dischargers from meeting required concentrations by dilution with nonregulated water, the regulations require that the

concentration at which the discharger is regulated be corrected for this dilution. Thus,

$$Y = \frac{X \cdot F}{F_1}$$

where

X = the specified requirement for the pollutant

F = the flow of regulated wastewater

F₁ = the combined flow of unregulated and regulated water

Similarly, the regulated value based on a consistent removal will be reduced for a facility that bypasses its treatment system when discharging to a municipality, to account

for the bypassing. The value is reduced by multiplying by:

$$\frac{8,760 - Z}{8,760}$$

where

8,760 = number of hours in a year
Z = number of hours treatment system bypassed per year

Certain conditions must be met before a municipality can receive a removal allowance for its industrial users. Of major importance, the removal allowance must not cause the municipality to violate its NPDES permit, or the disposal of the municipal sludge must not be impaired.

Before the general pretreatment regulations were revised (on October 29, 1979), it was also specified that the municipality applying for a removal allowance must have an approved pretreatment program. It is likely, however, that many municipalities will be unable to comply with this requirement in time for industries to meet their deadlines; therefore, the revised regulations provide for a conditional removal allowance for plants discharging to municipalities that intend to have pretreatment programs.

Specific Pretreatment Standards for Electroplaters

EPA promulgated pretreatment standards for electroplaters on September 7, 1979.¹ Corrections were printed on October 1, 1979,⁴ and March 25, 1980,⁵ and further corrections will be in print shortly.⁶ The industry was categorized to determine whether any of the categories (subparts) should have pretreatment standards different from the others. The regulations apply to all subparts (listed in Table 5).

Table 7.

Pretreatment Standards for Existing Sources:^a Alternative 1^b—Subparts A, B, and D-H^c

Pollutant	Pretreatment standard ^d (lb/10 ⁶ ft ² /operation)					
	Subparts A and D-G		Subpart B		Subpart H	
	Daily maximum	4-d average	Daily maximum	4-d average	Daily maximum	4-d average
Silver.....	(^d)	(^d)	9.6	5.9	(^d)	(^d)
Cyanide, total.....	15.2	8	15.2	8	13.7	18.2
Copper.....	36	21.5	36	21.5	82.1	49.4
Nickel.....	32.8	20.5	32.8	20.5	74.8	46.9
Chromium.....	55.9	32	55.9	32	127.6	73.1
Zinc.....	33.6	20.9	33.6	20.9	76.6	47.5
Lead.....	4.7	3.3	4.7	3.3	10.8	7.4
Cadmium.....	9.6	5.9	9.6	5.9	21.9	13.3
Total metals.....	84	54.7	84	54.7	191.5	124.7

^aPlants discharging more than 10,000 gal/d.

^bMass-based standards. Equivalent to and may apply in place of standards shown in Table 6 on agreement between source and receiving POTW.

^cDescribed in Table 5.

^dNot applicable.

SOURCES: U.S. Environmental Protection Agency, "Effluent Guidelines and Standards, Electroplating Point Source Category, Pretreatment Standards for Existing Sources," *Federal Register* 44(191):56330-56333, Oct. 1, 1979. U.S. Environmental Protection Agency, "Effluent Guidelines and Standards, Electroplating Point Source Category, Pretreatment Standards for Existing Sources; Correction," *Federal Register* 45(59):19245-19246, Mar. 25, 1980. U.S. Environmental Protection Agency, "Electroplating Point Source Category, Effluent Guidelines and Standards, Pretreatment Standards for Existing Sources," *Federal Register*, in preparation, 1980.

Table 6 gives the concentration-based limits for existing electroplating facilities.^b More lenient standards were adopted for plants discharging less than 10,000 gal/d (38,000 l/d). For plants discharging more than 10,000 gal/d (38,000 l/d), two alternative sets of standards can be adopted on agreement between the POTW and the industrial user.

Alternative 1 is mass-based limits (Table 7) that relate the allowable discharge of a pollutant to the quantity of work processed in terms of surface area and the number of plating operations performed. A plating operation is defined as any step in metal finishing that is followed by a rinsing step. An electroplater using Alternative 1 is eligible for POTW removal credits. Credit also can be taken for any significant levels of the regulated pollutants in the intake water.

^bAlthough EPA may specify more stringent pretreatment requirements in future, the new level is not directly tied to BAT for direct dischargers because other conditions (such as lack of space) will be part of the pretreatment evaluation.

Table 8.**Pretreatment Standards for Existing Sources:^a Alternative 2^b—Subparts A, B, and D-H^c**

Effluent characteristic	Pretreatment standard	
	Daily maximum	4-d average
Pollutant (mg/l):		
Cyanide, total.	1.9	1.0
Lead	0.6	0.4
Cadmium	1.2	0.7
Total suspended solids.	20.0	13.4
pH.	7.5-10.0	7.5-10.0

^aPlants discharging more than 10,000 gal/d.^bSimplified standards. An optional control program that may be selected by the source with concurrence of the control authority. Requires the absence of strong chelating agents, reduction of hexavalent chromium, and neutralization with CaO or Ca(OH)₂.^cDescribed in Table 5.

SOURCES: U.S. Environmental Protection Agency, "Effluent Guidelines and Standards, Electroplating Point Source Category, Pretreatment Standards for Existing Sources," *Federal Register* 44(191):56330-56333, Oct. 1, 1979. U.S. Environmental Protection Agency, "Effluent Guidelines and Standards, Electroplating Point Source Category, Pretreatment Standards for Existing Sources: Correction," *Federal Register* 45(59):19245-19246, Mar. 25, 1980. U.S. Environmental Protection Agency, "Electroplating Point Source Category, Effluent Guidelines and Standards, Pretreatment Standards for Existing Sources," *Federal Register*, in preparation, 1980.

Alternative 2 (Table 8) is designed to minimize the cost of monitoring the wastewater discharge. This standard replaces the limits on the level of copper, nickel, chromium, zinc, and total metals by limits on TSS and pH. Users of this alternative must reduce hexavalent chromium to its trivalent state and must neutralize the wastewater with lime [CaO or Ca(OH)₂]. Plants using strong chelating agents in processing are not allowed to use this standard because control of pH does not necessarily precipitate heavy metals in the presence of strong chelates.

3. Water Pollution Control Technologies

Selecting a System

To select a wastewater treatment system for compliance with water pollution control regulations, the following factors should be considered:

- The system's reliability to remove pollutants to the levels specified in the discharge permit
- The initial cost to install the system
- The day-to-day costs of operating the system (labor, utility, treatment reagents, and sludge disposal costs)

An additional factor is whether the system can be modified to comply with any future regulations calling for increased pollutant removal efficiencies.

The procedure for selecting a treatment process entails the following general tasks:

- Performing field investigations to define the waste stream parameters (flow rate, pollutant types, wastewater variability)
- Developing conceptual models of proposed treatment processes based on the field investigation
- Conducting bench-scale treatability studies on wastewater samples to simulate the proposed processes
- Using results of the treatability studies to assess the ability of the proposed systems to meet discharge requirements
- Using data from the treatability study assessment to determine design parameters needed to specify a full-size system
- Estimating the cost to install and operate the proposed system, based on the design parameters needed for adequate pollutant removal and on vendor quotations for the equipment specified

The major influences on the investment needed for a wastewater treatment system are:

- Unit operations required, for example, chromium reduction, cyanide oxidation, and neutralization
- Volumetric flow of wastewater, which determines the size requirements of the different processing units

Most waste streams generated in the electroplating industry can be treated by simple alkali neutralization to adjust the wastewater pH and thereby reduce the solubility of the dissolved metals. This step must be followed by solids separation to remove the suspended solids and precipitated metals. Additional treatment steps are typically required for plants employing chromium or cyanide plating processes or plating solutions containing strong chelating compounds. Waste streams from these operations must be treated before they are mixed with the combined wastewater streams that feed the central alkali precipitation process.

Once a specified treatment system is installed, many of the operating costs, such as labor requirements and electrical consumption, are fixed. Costs for treatment chemicals and solid waste disposal vary, however, and depend primarily on the mass flow of pollutants and the flow rate of wastewater. Consequently, before a treatment system is selected, it is important to evaluate options available for reducing the volume of wastewater and for reducing or eliminating the entry of pollutants into the wastewater. Incorporating waste-reduction modifications in the plating process can significantly reduce the investment for treatment system installation and can reduce operating cost after installation. If installing a recovery process reduces the investment needed for treatment hardware, in some cases the saving will make the investment in the recovery process cost effective.

Resource Recovery and Pollutant Load Reduction Modifications

Pollution control legislation has affected industry by increasing the economic penalty associated with inefficient use of raw materials. In the plating industry, for example, loss of a raw material in the wastewater can result in three distinct cost items: replacement of the material, removal of the material from the wastewater before discharge, and disposal of the residue. Similar cost items exist for process water: replacement of water (no longer inexpensive to purchase) used in processing, processing the water in the wastewater treatment system, and processing the water by the POTW after discharge into a sewer system.

In response to the increased cost of raw material losses, plating shops are modifying their processes to reduce these losses as well as water consumption. Recent years also have seen the cost-effective application of various separation processes that reclaim plating chemicals from rinse waters, enabling both the raw material and the water to be reused.

The impact of resource recovery and pollutant load reduction modifications on waste treatment and solid waste disposal costs must be measured if these modifications are to be evaluated. Cost of sophisticated treatment necessary for electroplating wastewater and of residue disposal often provides a significant economic incentive for resource recovery.

Case History 1 in Section 4 highlights the significance of the foregoing cost factors. If the evaporator installation were justified only by the value of the chromium recovered, the investment would appear to result in a significant loss. If reduced pollution control costs were included, a net profit would result, but the investment

still would not be very lucrative. Use of rapid write-off techniques allowed for pollution control equipment, however, would result in a payback of just under 3 years, a rate acceptable for most companies. Section 6 describes in detail some tax benefits and Federal programs that facilitate pollution-control-oriented capital projects.

Modifications for reducing the pollutant or wastewater loading on a treatment facility range from using flow restrictors to eliminate excess dilution in rinse tanks to installing recovery units, such as reverse osmosis and evaporation, to separate plating chemicals from rinse water for recycle to the plating bath. Actions that can minimize wastewater volume include:

- Implementing rigorous house-keeping practices to locate and repair water leaks quickly
- Employing multiple counterflow rinse tanks to reduce rinse water use substantially
- Employing spray rinses to minimize rinse water use
- Using conductivity cells to avoid excess dilution in the rinse tanks
- Installing flow regulators to minimize water use
- Reusing contaminated rinse water and treated wastewater where feasible

Steps to minimize pollutant loading include:

- Implementing a rigorous house-keeping program to locate and repair leaks around process baths, replacing faulty insulation on plating racks to prevent excessive solution drag-out, installing drip trays where needed, and so forth
- Using spray rinses or air knives to minimize solution drag-out from plating baths

- Recycling rinse water to plating bath to compensate for surface evaporation losses (see Section 4, Case History 2)
- Using spent process solutions as wastewater treatment reagents (acid and alkaline cleaning baths are obvious examples)
- Using minimum process bath chemical concentrations
- Installing recovery processes to reclaim plating chemicals from rinse waters for recycle to the plating bath
- Using process bath purification to control the level of impurities and prolong the bath's service life

Closed-loop chemical recovery from a rinse stream (as shown in Case History 1) can often provide the solution to handling wastes that are difficult or expensive to treat. Applying a closed-loop recovery system to a plating operation eliminates the need to treat the rinse water normally associated with that step.

In the case of rinse streams requiring pretreatment (for example, cyanide or chromium) or rinses containing pollutants not effectively removed by conventional end-of-pipe technology (for example, some types of complexed metals), installing a closed-loop system to recycle the rinse may reduce the investment needed to comply with the effluent quality limitations. A small-volume purge stream will result from closed-loop operation, but treatment or disposal of this stream should not be a major expense.

EPA has funded research into assessing the effectiveness of methods for recovering plating materials for reuse in the plating process. Reports from this research are available in the following subject areas:

- General⁷⁻¹²
- Evaporation^{13,14}
- Reverse osmosis^{15,19}
- Electrodialysis^{20,21}

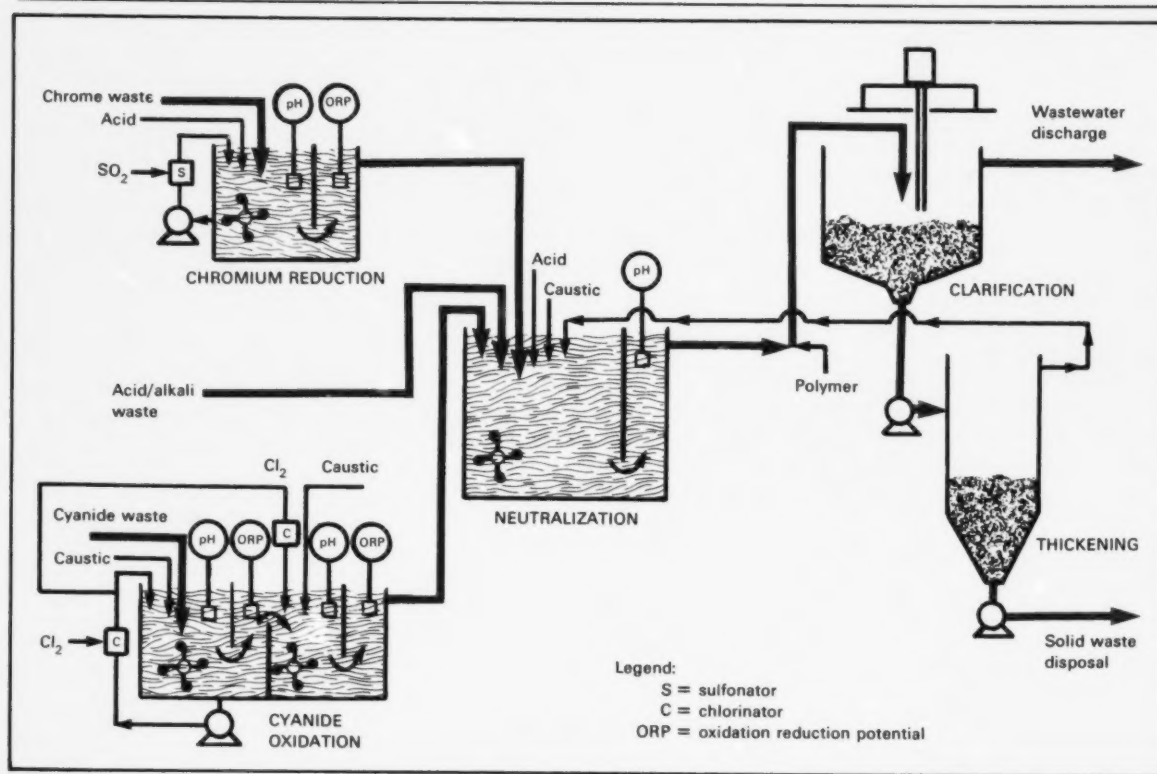


Figure 1.

Electroplating Industry Conventional Wastewater Treatment

Conventional Wastewater Treatment

The pollutant discharge levels called for in the pretreatment regulations were based on the performance of numerous electroplating wastewater treatment systems observed by EPA contractors. Most plating shops employ a conventional wastewater treatment process to remove pollutants from the discharge.

Conventional wastewater treatment in the electroplating industry consists of the following unit processes (Figure 1):

- Chromium reduction: (if needed) of segregated chromium waste streams to reduce the chromium from its hexavalent form to the trivalent state, which then can be precipitated as chromium

hydroxide by alkali neutralization

- Cyanide oxidation (if needed) of segregated cyanide-bearing waste streams to oxidize the toxic cyanides to harmless carbon and nitrogen compounds
- Neutralization of the combined metal-bearing wastewaters, acid/alkali wastewaters, strong chemical dumps, and the effluent from the cyanide and chromium treatment systems to adjust the pH within acceptable discharge limits and precipitate the dissolved heavy metals as metal hydroxides
- Clarification where flocculating/coagulating chemicals are added to promote the initial settling of the precipitated metal hydroxides

- Gravity thickening over extended time to increase solids content of sludge before disposal

These unit processes provide effective, reliable treatment for many electroplating waste streams. That is not to say, however, that such treatment is suitable for all applications or that the "normal" design parameters (retention time, reagent dosage, and so forth) will provide effective pollutant removal from every individual plater's wastewater discharge. Treatability studies are needed to assess the applicability of a treatment process to a specific wastewater. Case History 3, in Section 4, discusses a system that employs conventional treatment, but uses stream segregation to achieve the pollutant levels called for in the discharge permit.

Alternative Methods of Treatment

Several alternative treatment processes have been developed to overcome the problems encountered in treating many waste streams in the conventional manner. The most attention has been given the frequent inability of the hydroxide neutralization/metal precipitation process to reduce the solubility of dissolved metals to the low levels required for discharge of the waste stream. The problem arises because many plating wastewaters contain compounds that interact with dissolved metals and interfere with their precipitation as metal hydroxides. Such compounds as ammonia, phosphates, tartrates, and EDTA^c are commonly used in plating operations and consequently find their way into the wastewater. These compounds, called chelates, combine with the dissolved metal ion to form a complexed ion that is relatively soluble in neutral or slightly alkaline solutions.

The means of overcoming the solubilizing effects of chelating agents can be grouped under two categories:

- Precipitation/removal of the metal from solution by a method that, unlike hydroxide precipitation, is relatively immune to the chelating effects of these compounds
- Pretreatment of the wastewater to free the metal ion from the chelating agent

The first category includes such processes as sulfide precipitation, water-insoluble starch xanthate (ISX) precipitation, and ion exchange.

Sulfide precipitation, which precipitates metals as sulfides instead of hydroxides, has been found capable of achieving low levels of metal solubility in highly chelated waste streams. The process has been proven as an alternative to hydroxide precipitation or as a method for further reducing the dissolved metal concentration in the effluent from a hydroxide precipitation system. (See Section 4, Case History 4.)

ISX precipitation can remove heavy metal cations from wastewaters. The ISX acts as an ion exchange material that removes heavy metal ions and replaces them with sodium or magnesium ions. Currently it is applied as an alternative to hydroxide precipitation or to "polish" treated wastewater to lower the residual metal concentration. Because it is insoluble in water and its precipitation reaction rate is rapid, ISX is used either as a slurry with the stream to be treated or as a precoat on a filter. The waste stream is then passed through the filter cake.

Ion exchange, using resins that have a strong selectivity for heavy metal ions (as opposed to the calcium and sodium ions normally present in the wastewater), has been proven effective in lowering the metal concentration in the wastewater discharge. (See Section 4, Case History 5.)

Pretreatment of complexed waste streams usually involves segregating the waste streams and either raising the pH to a highly alkaline level (high pH lime treatment) or lowering it to an acidic condition. At these extreme pH conditions, the metal complex often dissociates, freeing the metal ion. A suitable nontoxic soluble cation (e.g., calcium) then can be used to tie up the complex so that it does not recombine with the metal when the pH is readjusted. This type of treatment will require

high reagent dosage, but has been proven effective for treating many complexed wastewaters.

In some cases, segregating a difficult-to-treat waste stream, precipitating the dissolved metal at the ideal pH, separating the precipitated solids, then diluting this stream with the rest of the wastewater before discharge will reduce the concentration of the metal to a level acceptable for discharge. Lowering the volume of the segregated waste stream can keep costs at a minimum and improve effectiveness.

Another frequent problem in wastewater treatment is that metal discharge requirements are not being met, even though the level of dissolved metals in the effluent is low. In cases of this kind, the solids separation component of the process is allowing too much suspended matter, including precipitated metals, to pass into the discharge. This condition can result from overloading the clarifiers, ineffective conditioning (coagulation or flocculation) of the clarifier feed, or poor pH control. Modifications that can correct the problem include:

- Improved effectiveness of the conditioning system to produce a more settleable particle
- More reliable pH control
- Reduced volumetric load on the clarifier
- Use of a solids removal polishing device, such as a sand or mixed media filter, to lower the clarifier overflow turbidity level

Other wastewater treatment developments have included substitute processes for chromium reduction (electrochemical reduction is an example), cyanide oxidation (ozonation has been used, for example), and others.

^cEthylenediaminetetraacetic acid.

Several treatment choices are available to the plater, and proper process selection and design will ensure that the system can meet the current discharge requirements. EPA has funded research into assessing the cost and effectiveness of many applicable wastewater treatment techniques. Reports are available as follows:

- General^{7-12,22-24}
- Integrated treatment^{25,26}
- Sulfide precipitation^{27,28}
- Cyanide waste treatment²⁹⁻³¹
- Other³²⁻³⁵

Cost Implications of Direct Wastewater Discharge

Satisfying the pretreatment requirements for discharge to a POTW often can result in a waste stream suitable for direct discharge to receiving waters. The advent of POTW's using advanced treatment processes has brought significant increases in the sewer fees charged to industrial firms using the public system. If an outfall is available, it might be possible to reduce cost by avoiding the system. Assuming the wastewater BOD level is acceptable for discharge, it is not likely that any of the residual pollutants will be removed in the POTW.

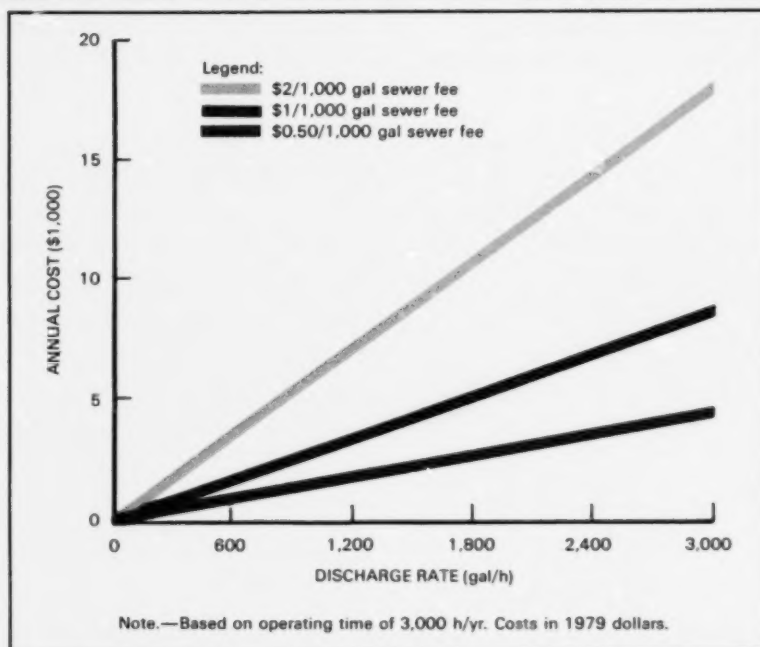


Figure 2.
Annual Sewer Fee as a Function of Flow Rate

Figure 2 presents the annual sewer fee levied against a firm as a function of its discharge rate over a range of typical rate structures. This

fee represents the incentive to consider direct discharge despite the more stringent sampling and reporting requirements associated with the practice.

4. Water Pollution Control Case Histories

Case History 1. Economic Evaluation of Evaporator Installation

The Phillips Plating Company, Phillips, Wisconsin, installed a 75-gal/h (280-l/h) rising film evaporator to concentrate the chromium plating bath drag-out in the rinse stream for recycle to the plating bath. Installation of the closed-loop recovery system reduced the addition of anhydrous chromic acid (CrO_3) to the plating solution by approximately 4 lb/h (1.8 kg/h). The total cost to install the recovery system was approximately \$60,000. (All costs are in 1979 dollars.) Table 9 breaks down the operating costs associated with the system and the savings achieved by installing the unit.

Considering only the saving in plating chemicals, the investment would appear to lose approximately \$9,000/yr. If the analysis includes the savings in treatment chemicals

(Phillips uses a Sulfex™ insoluble sulfide treatment system) and solid waste disposal charges (based on disposal at 25 percent solids by weight at a cost of \$0.19/gal of sludge), the saving is an additional \$28,400/yr. With this added saving, the system would pay for itself in just under 4 years. Taking advantage of the investment tax credit and the rapid write-off depreciation allowance for pollution control equipment, it was possible to reduce the investment payback to under 3 years, a most acceptable investment rate of return. The situation at Phillips Plating highlights the need to consider these three factors in evaluating chemical recovery modifications.

The major operating cost for the recovery system is the cost of energy used to supply steam to the unit. In a closed-loop system of the kind shown in Figure 3a, the rinse

Table 9.
Economic Evaluation for Evaporator Installation

Item	Amount
Installed cost for 75-gal/h evaporator (\$/yr)	60,000
Annual costs at 6,000 h/yr (\$/yr):	
Depreciation (10-yr life)	6,000
Taxes and insurance	600
Maintenance	3,600
Labor (½ h/shift at \$6/h)	2,250
Utilities:	
Steam (at \$3.50/10 ⁶ Btu)	15,000
Electricity	600
General plant overhead	2,600
Total annual cost	30,650
Annual savings (\$/yr):	
Replacement CrO_3	21,600
Waste treatment reagents	23,000
Sludge disposal	5,400
Total annual savings	50,000
Net savings after tax (\$)	10,000
Payback after tax (yr)	3.8
Payback if 5% investment tax credit and 5-yr rapid write-off are used (yr)	2.6

Note.—Costs in 1979 dollars.

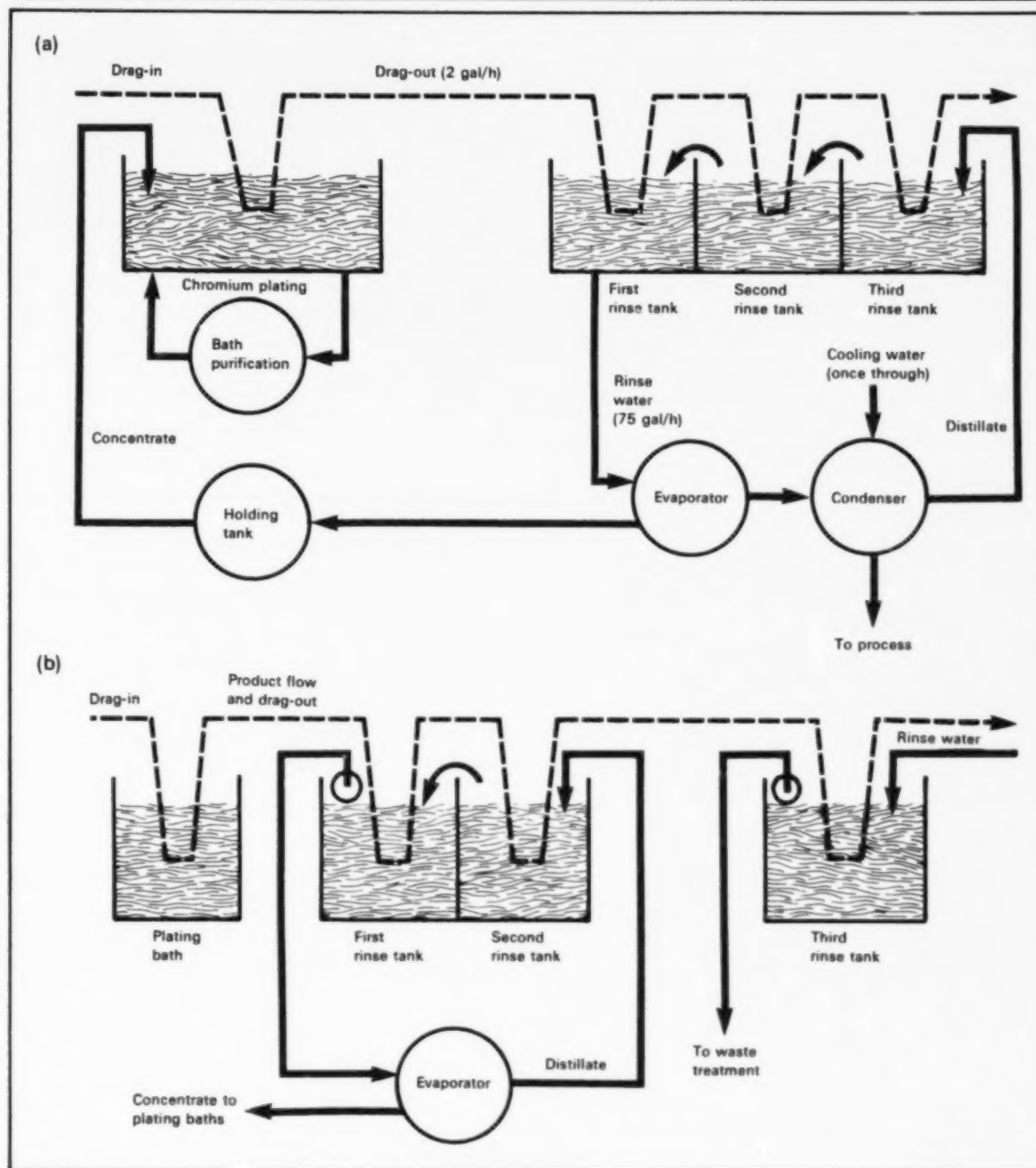


Figure 3.
Evaporative Recovery Systems: (a) Closed Loop and (b) Open Loop

rate, which equals the evaporative duty, must be sufficient to provide adequate rinsing. If Phillips were to use an open-loop recovery system in the first two rinse tanks (Figure 3b) and were to use the final rinse tank to ensure adequate rinsing, the plant could still achieve significant drag-out recovery. This approach would significantly reduce the steam costs and also would require a smaller, less expensive evaporator. Figure 4 combines the annual fixed and variable operating costs for different evaporator feed rates and compares the resulting annual costs with the saving the plant would realize from recovered chromium and lower pollution control costs.

Case History 2. Automated Direct Drag-out Recovery

The Gillette Company, Safety Razor Division, in Boston, installed an automated direct drag-out

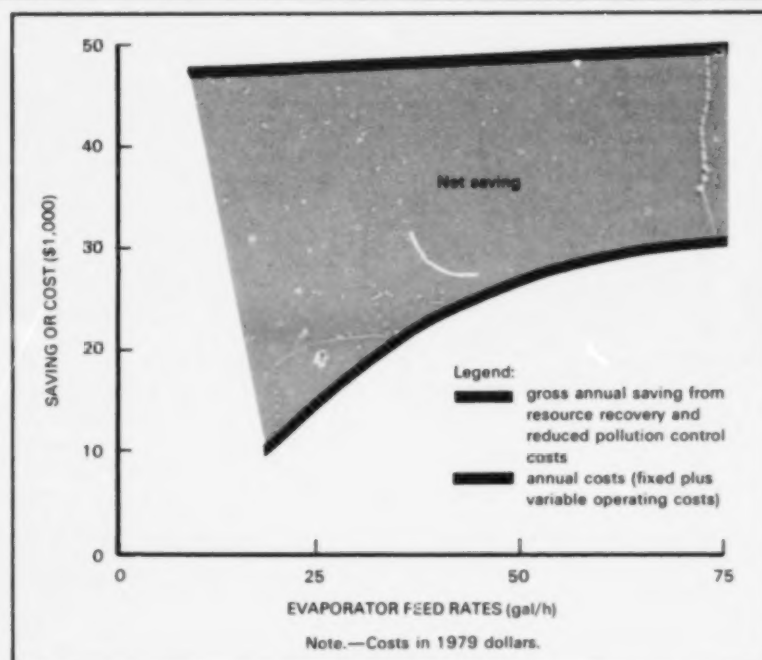


Figure 4.

Cost Versus Feed Rate for Open-Loop Evaporator System

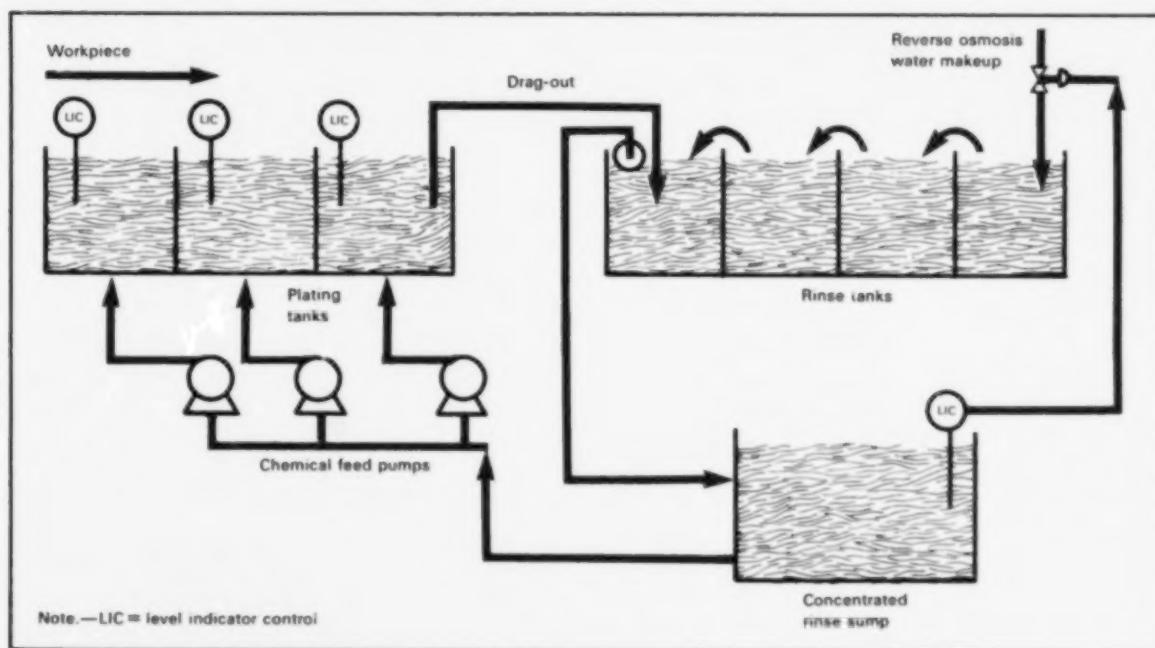


Figure 5.

Automated Direct Drag-out Recovery

recovery system that recovered 85 percent of the nickel drag-out from three barrel-plating tanks. The system (Figure 5) employs four countercurrent tanks to provide both rinsing of the parts and a source of solution makeup in the plating tanks. The drag-out recovery system allows closed-loop operation of the nickel plating bath; all rinse water is recycled to the plating bath with no flows to waste treatment.

Level control probes in the three plating tanks control the addition of concentrated rinse to make up for surface evaporation losses from that tank. A level control in the concentrated rinse water sump controls the addition of fresh makeup water in the last rinse tank. To minimize the buildup of impurities in the system, the makeup water is purified by a compact reverse osmosis water purification unit. The system installed at Gillette included the reverse osmosis unit, the three chemical transfer pumps, the concentrated rinse sump (operating on the U-tube principle), a control panel, and the necessary control loops. The total cost was \$8,500.

Three factors determine the percentage of drag-out that can be recovered when this approach is used:

- The surface evaporation rate from the plating tank, which determines the amount of rinse water that can be recycled
- The ratio of the drag-out volume to the volume of rinse water recycled to the plating bath
- The number of countercurrent rinses used for recovery

Figure 6 shows the percentage of drag-out that can be reclaimed in terms of these factors.

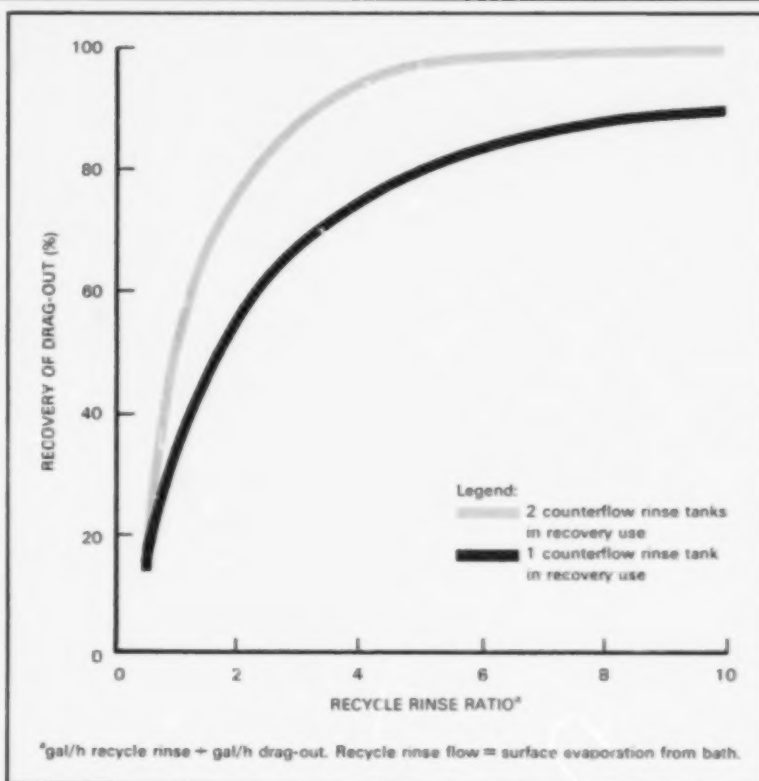


Figure 6.
Percentage of Drag-out Recovery With Rinse-and-Recycle System

Case History 3. Stream Segregation To Enhance Conventional Treatment System Performance

The Medford Plastics Company, Medford, Wisconsin, is engaged in plating copper, nickel, and chromium on plastic components. The plant recently installed the wastewater treatment system shown in Figure 7.

During the treatability studies conducted before a system was selected, it became obvious that the nickel concentration could not be reduced in a common treatment system to the level required by the discharge permit. It was proposed to segregate the electroless nickel plating rinse flow

from the rest of the wastewater. A system was evaluated for precipitating the nickel at a high pH, clarifying the suspended solids, then mixing the nickel rinse effluent with the balance of the wastewater before discharge. Testing indicated that this approach should provide a total effluent nickel concentration below the permit specifications.

Table 10 shows that the treated discharge achieves the removal levels called for in the discharge permit. When the system was first installed, however, the discharge consistently exceeded the nickel level requirement. To correct this problem, the plant cut the flow to the

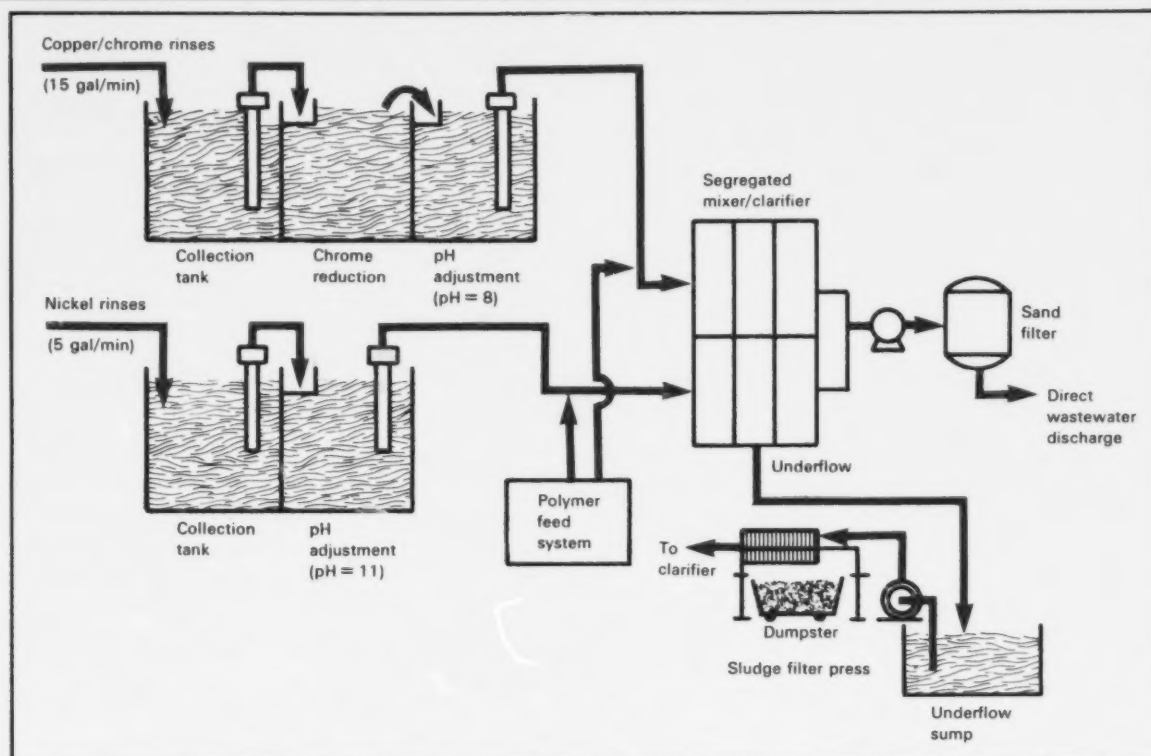


Figure 7.

Treatment System With Waste Stream Segregation

Table 10.

Permit Requirements and Treated Effluent Quality: Waste Stream Segregation

Effluent characteristic	Permit requirements ^a	Treated effluent
Total suspended solids (lb/d).....	8.8	<0.1
Chromium (lb/d):		
Total.....	0.22	0.13
Hexavalent.....	0.02	0.004
Nickel (ppm).....	1.3	0.16
Copper (ppm).....	0.17	0.06
pH.....	6.0-9.5	9.3

^aMonthly average of daily values.

nickel treatment system in half by further counterflowing the rinses. The increased retention time in the treatment system and the greater dilution achieved when the nickel wastewater was mixed with the copper-chrome wastewater eliminated the problem.

Case History 4. Sulfide Precipitation

Holly Carburetor, a Division of Colt Industries, in Paris, Tennessee, manufactures carburetors for major

auto makers and as replacement parts. Part of the wastewater from the plant results from surface treatment of parts used in assembling the carburetors. This waste stream contains varying concentrations of iron, zinc, and chromium (hexavalent and trivalent); it is treated by The Permutit Company's Sulfex™ treatment system. The system was installed as an EPA demonstration project funded under a grant made to the National Association of Metal Finishers. Figure 8 shows the equipment components of a treatment system using sulfide precipitation.

The Sulfex™ system precipitates metals as sulfides instead of hydroxides. Because metal sulfides are considerably less soluble than hydroxides, lower metal concentrations can be achieved

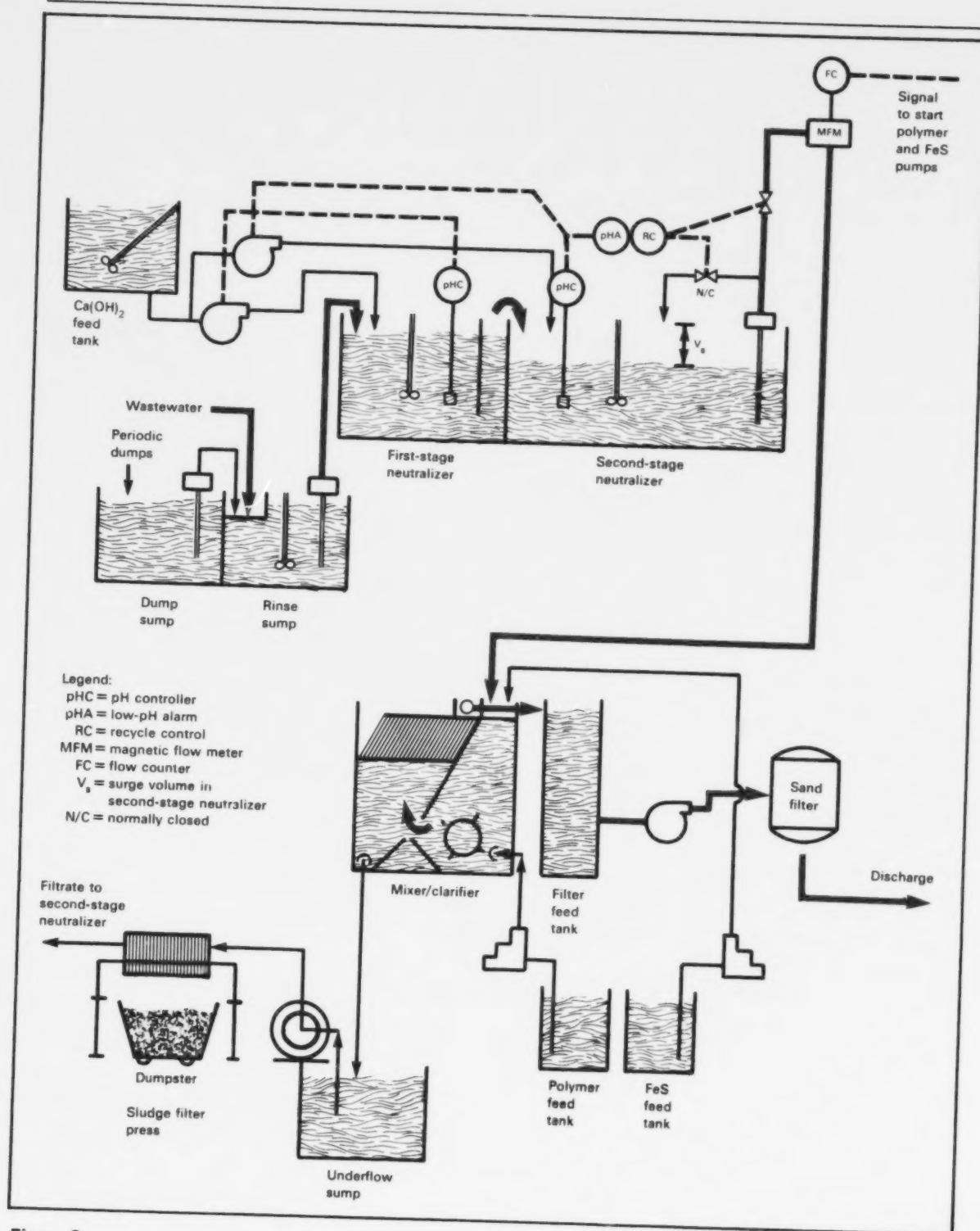


Figure 8.
Treatment Process With Sulfide Precipitation

in the effluent. Table 11 compares Holly Carburetor's effluent quality with the city treatment system discharge requirements, showing the system to be effective in removing the metals to the required levels.

Two distinct sulfide precipitation processes (insoluble and soluble) are being used to treat wastewaters containing heavy metals. The system at Holly Carburetor is known as insoluble sulfide precipitation (ISP), in which ferrous sulfide is the sulfide source. Ferrous sulfide is relatively insoluble in water; consequently, the level of dissolved sulfide in the wastewater is kept at a minimum. The main advantage of ISP over the soluble sulfide approach is that there is no detectable H_2S odor associated with the process.

Soluble sulfide precipitation (SSP) uses a water-soluble reagent, such as sodium hydrosulfide ($NaHS$) or sodium sulfide (Na_2S). SSP has been applied to treat complexed metal finishing wastewaters and has achieved lower metal concentrations compared with treatment by hydroxide precipitation.

Most of the equipment components of both ISP and SSP systems are common to hydroxide systems. Consequently, these processes offer a means of modifying an existing hydroxide system to improve metal removal capability.

Case History 5. Ion Exchange for Selective Heavy Metal Removal

The Hurd Lock and Manufacturing Company, Greenville, Tennessee, employs a combination treatment system using batch treatment of wastewater collected in four different treatment sumps. The wastewater collected in each sump is processed separately through the system shown in Figure 9. The continuous treatment system for

Table 11.

State Requirements and Treated Effluent Quality: Sulfide Precipitation

Pollutant (mg/l)	Tennessee guidelines for indirect discharge	Treated effluent
Zinc.....	5.0	0.015
Hexavalent chromium.....	0.05	0.02
Total chromium.....	5.0	0.10
Copper.....	5.0	(^a)

^aBelow detectable limits.



Cyanide process bath, with double-effect evaporators at left

each batch employs the following steps:

- Chromium reduction (not always required)
- Neutralization (the pH set-point adjusted to achieve maximum metal removal for each waste processed)
- Flocculation (with polymer addition)
- Pressure filtration (with diatomaceous earth precoat)
- Ion exchange polishing

The ion exchange polishing step reduces the concentration of metals to the level required for discharge. Table 12 presents the discharge quality and the requirements set forth in the permit. The system was required to meet the same level of metal concentration as that called for in the effluent discharged from the city's treatment system. The plant was allowed to exceed the chemical oxygen demand (COD) level allowed

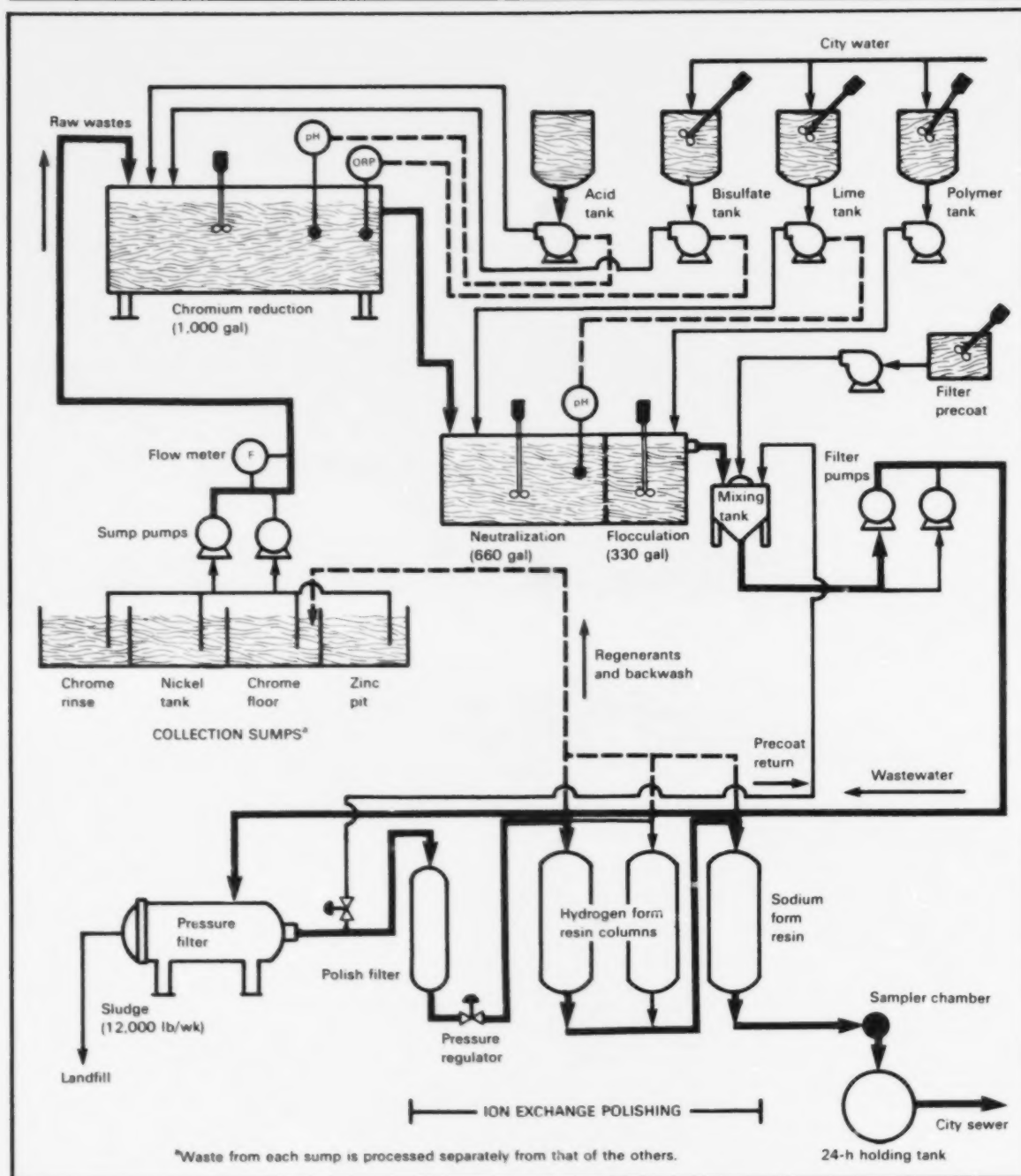


Figure 9.
Continuous Treatment System

Table 12.**Permit Requirements and Treated Effluent Quality: Ion Exchange**

Effluent characteristic	Permit requirements	Treated effluent			
		Chrome floor	Chrome rinses	Nickel rinses	Zinc pit
pH	6.5-8.5	11.0	11.0	6.9	11.6
Color units	12	0	0	0	0
Pollutant (mg/l):					
Total suspended solids ..	15	<1.0	<1.0	<1.0	<1.0
COD	20	928	210	217	500
Cadmium	0.01	<0.005	<0.005	<0.005	<0.005
Chromium	0.05	<0.02	<0.02	<0.02	<0.02
Copper	0.05	<0.05	<0.05	<0.05	<0.05
Iron	0.50	<0.05	<0.05	<0.05	<0.05
Lead	0.05	<0.05	<0.05	<0.05	<0.05
Nickel	0.10	<0.05	<0.05	<0.05	<0.05
Zinc	0.10	<0.02	<0.02	<0.02	<0.02

for discharge because this pollutant could be effectively reduced by subsequent treatment. Table 12 shows that all metal level requirements were met.

The resin used in the ion-exchange columns selectively removes heavy metals from the waste, but allows alkali and alkaline earth cations to pass through. A two-stage ion exchange treatment achieved best results. The first stage uses a hydrogen ion resin; the second stage uses a sodium ion resin. The plant shifted from caustic soda to lime for neutralization, because the resin proved more selective for heavy metal in the presence of calcium ions.

5. Solid Waste Management

Hazardous Waste Regulations

EPA has promulgated regulations designed to manage and control the country's hazardous wastes from generation to final disposal. These regulations are a result of a directive to EPA by Congress in the Resource Conservation and Recovery Act (RCRA) of 1976 (Public Law 94-580). Congressional concern was prompted by the large quantities of solid wastes being generated. Some solid waste problems result from meeting requirements of Federal and State laws, some from processes themselves, and others from generally inadequate and environmentally unsound practices used in the disposal or handling of wastes.

The RCRA regulations differ from those concerned with air and water pollution in that air and water regulations vary according to the specific industry (for example, electroplating) to which they are directed, whereas all industries that generate, store, haul, or dispose of hazardous waste must comply with the same set of rules. Most electroplating facilities will be considered generators of hazardous waste and may be considered storage or disposal facilities. The procedures to determine if wastes are hazardous and the requirements for generators, storers, and disposers of hazardous wastes follow.

Identification of Hazardous Wastes

Under the regulations, promulgated in May 1980,³⁶ solid wastes include all substances destined for disposal and not already regulated by the Clean Water Act or the Atomic Energy Act of 1954.

EPA has developed the following list of characteristics as criteria for determining which solid

wastes must be classified as hazardous:

- Ignitability
- Corrosivity
- Reactivity
- Toxicity of leachates
- Radioactivity
- Infectiousness
- Phytotoxicity (toxicity to plants)
- Teratogenicity and mutagenicity (ability to cause mutations)

A waste possessing one or more of these traits will be declared hazardous. The following electroplating wastes are assumed to be hazardous unless proved otherwise:

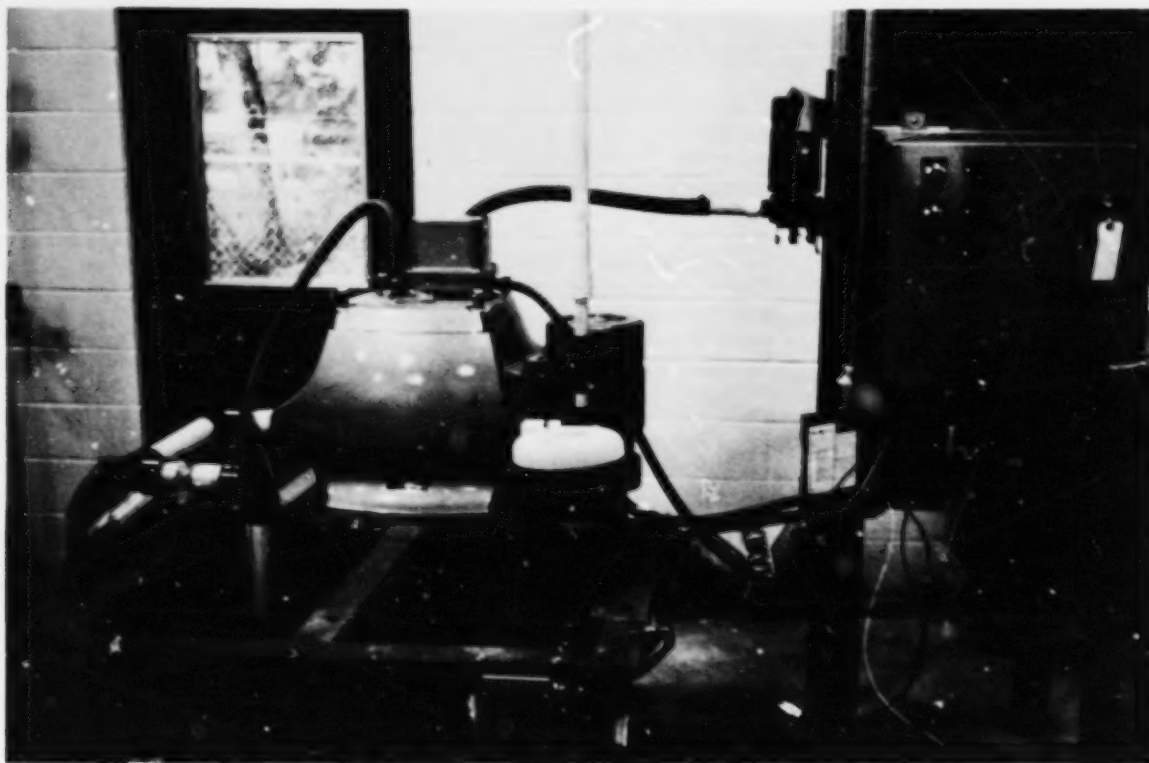
- Wastewater treatment sludges (toxic)
- Spent plating bath solutions (reactive and toxic)
- Sludges from the bottom of plating baths (reactive and toxic)
- Spent stripping and cleaning bath solutions (reactive and toxic)

The corrosivity criterion is used to determine if these materials can extract toxic contaminants from other wastes or make them soluble. A material is corrosive if it has a pH below 2 or above 12.5, or if it corrodes steel (following a test developed by the National Association of Corrosion Engineers).

Reactive wastes have one or more of the following tendencies:

- To autopolymerize
- To create a vigorous reaction with air or water
- To exhibit thermal instability with regard to shock or to the generation of toxic gases
- To explode

The final characteristic, toxicity, is the one of most importance to electroplaters. If disposed of improperly, toxic wastes may



Small centrifuge

release toxic materials in sufficient amounts to pose a substantial hazard to human health or to the environment. EPA has designed a leaching test (called the Extraction Procedure) to measure the amount of toxic materials that can be extracted from the waste at a pH of 5, during a 24-hour period, with constant stirring. If the extract obtained from the test exceeds set limits for certain contaminants, the waste will be considered hazardous. Eight metals are among the 14 materials selected as toxic; several of these metals are commonly used in electroplating. Table 13 lists the specific metals with the standard for each. Other materials may be added to the list in the future.

Table 13.

Toxic Waste Limits Set by EPA's Extraction Procedure

Pollutant	Extract level (mg/l)
Arsenic.....	5.0
Barium.....	100.0
Cadmium.....	1.0
Chromium.....	5.0
Lead.....	5.0
Mercury.....	0.2
Selenium.....	1.0
Silver.....	5.0

SOURCE: U.S. Environmental Protection Agency, "Hazardous Waste Management System: Identification and Listing of Hazardous Waste," Pt. 3, *Federal Register* 45(98):33084-33133, May 19, 1980.

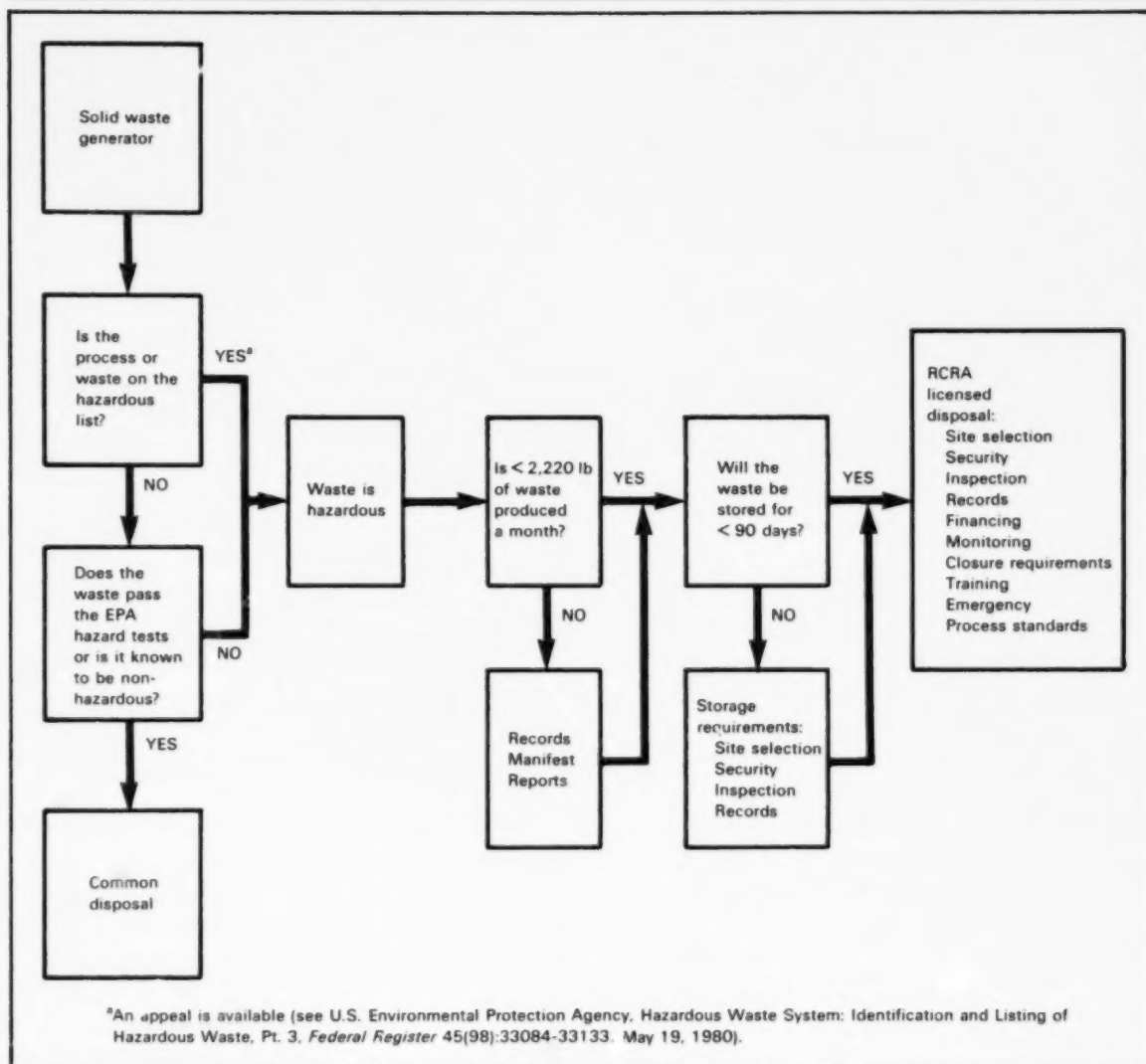


Figure 10.

Generator Obligations Under the Resources Conservation and Recovery Act

Requirements for Hazardous Waste Generators

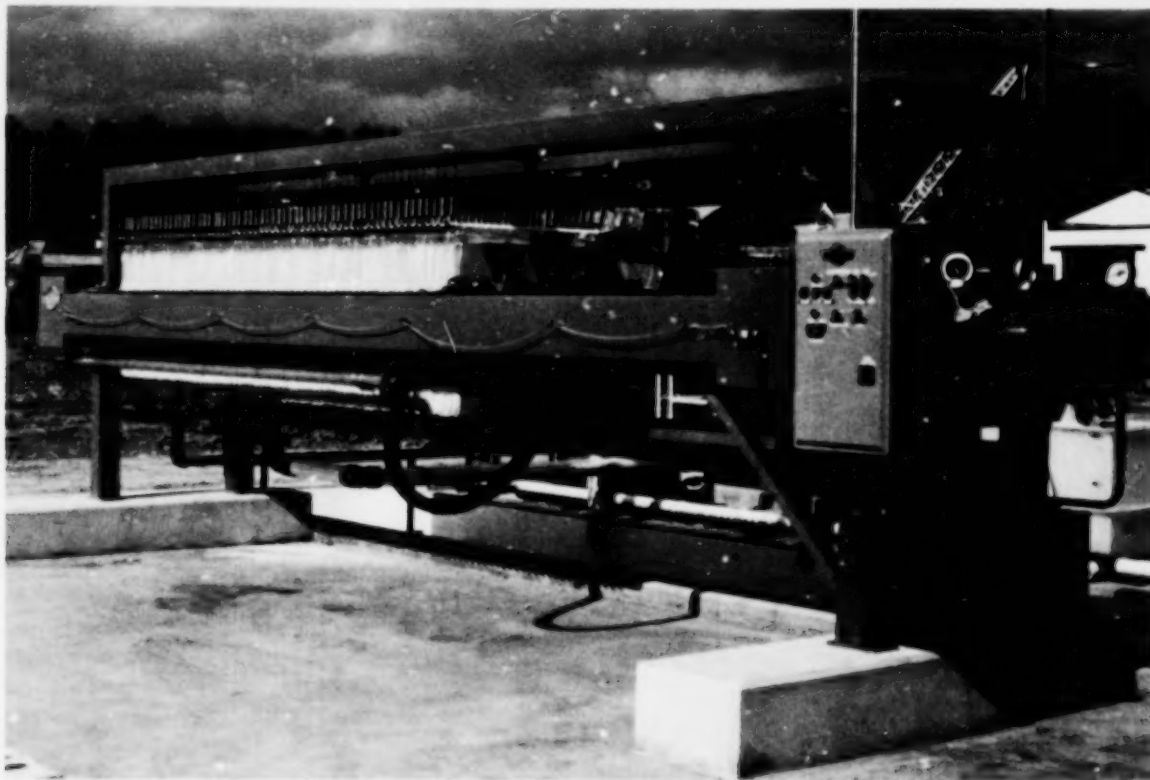
Producers of hazardous waste are considered generators under the regulations. It is a generator's responsibility to determine if the waste is hazardous by conducting EPA-specified tests, or the generator may simply declare the waste hazardous. If the waste is known to be nonhazardous, testing is not

necessary; however, the generator is responsible for the accuracy of that determination.

Generators of hazardous wastes are responsible for notifying EPA of their activities, using appropriate containers, labeling the

containers, and ensuring proper disposal (Figure 10). The law also requires generators who produce and dispose of more than 2,200 lb (1,000 kg) of hazardous waste per month, with certain exceptions, to use a manifest system to ensure proper transport and disposal.

The manifest records the movement of hazardous wastes from the



Recessed plate filter press

generator's premises to an authorized off-site treatment, storage, or disposal facility. The manifest, signed by the generator, transporter, and disposer, is an official record that all Department of Transportation (DOT) and EPA requirements have been met. The generator must maintain original copies for 3 years, and must report to EPA if the manifest is not returned in 45 days.

Exception reports are required, listing any unreturned manifests. Annual reports, documenting shipments of all hazardous wastes originating during the report year, also are required.

In general, all information submitted by a generator is available to the public to the extent authorized by the Freedom of Information Act and EPA regulations associated with that act.

Requirements for Storage and Disposal Facilities

When wastes are stored on site for 90 days or longer, the generator falls under an additional set of regulations designed to control owners and operators of hazardous waste storage and disposal facilities. The standards for storage, promulgated in May 1980,³⁷ are intended to prevent the release of hazardous waste from storage areas into the environment.

Hazardous wastes must be stored in tanks and containers that meet specifications established by EPA for the storage of flammable and combustible liquids. Beyond these specifications, materials compatible with the hazardous waste must be used to construct or to line the containers.

Storage areas must have a continuous base impervious to the material being stored and must be designed for spill containment with either dikes or trenches, which require daily visual inspection. Throughout the storage period, records must be maintained showing the

identity and location of all stored hazardous wastes. Site selection requirements apply, and leachate monitoring may be required. Obviously, it is an economic advantage not to be classified as a storage facility.

As stated earlier, these standards only apply to those who store hazardous wastes for 90 days or more. For shorter durations, no recordkeeping is required.

Reduction of Sludge Volume and Disposal Cost

The treatment of electroplating wastewater, as required by the national pretreatment standards, will result in two streams:

- An effluent that must comply with regulations for acceptable pollutant discharge
- A residue (sludge) containing a high concentration of the substances identified by the pretreatment regulations for removal from the discharge

Because electroplating wastewater treatment systems commonly remove many of the metals regulated, most of these sludges will be considered hazardous. Many other electroplating shop wastes will also be considered hazardous.

EPA estimated recently that 90 percent of the sites accepting hazardous waste do not comply with present and proposed regulations governing hazardous waste disposal. Upgrading a site to comply with the regulations will significantly increase the cost of operating the site, and this cost increase will be passed on to the generator of the waste.

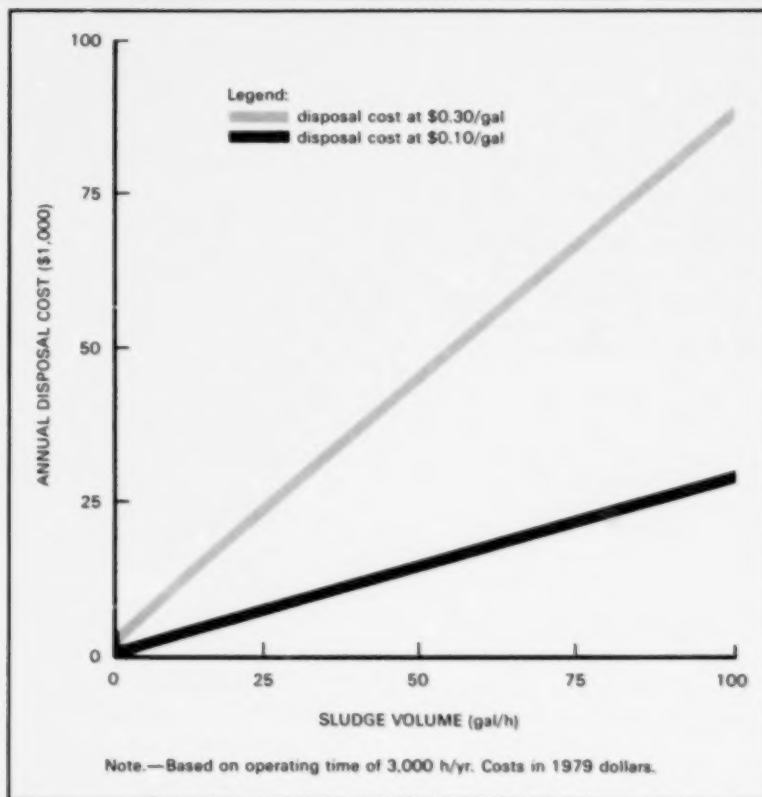


Figure 11.
Annual Cost for Sludge Disposal

The cost to dispose of waste treatment sludge depends on the volume of sludge to be disposed of, the unit cost to transport the sludge to a licensed disposal site, and the fee charged by the disposal site to accept the sludge. Because the last two factors are not likely to be under the control of the sludge generator, reductions in disposal cost derive primarily from reduction of the volume of waste generated.

Sludge disposal cost in a particular area is determined by the level of controls governing disposal

in that region. Many States already have established rigorous control procedures, and disposal costs range from \$0.10/gal to \$0.75/gal for metal-bearing waste sludge; most costs are between \$0.15/gal and \$0.25/gal. As RCRA is implemented nationally, inexpensive sludge disposal will become a thing of the past. Figure 11 shows the annual disposal cost in terms of sludge disposal rate (volume) and cost per gallon.

Sludge generation rates and disposal costs can be reduced by:

- Reducing the mass of pollutant entering the waste treatment system
- Reducing the wastewater volume entering the treatment system
- Using wastewater treatment techniques that generate minimum quantities of sludge
- Reducing sludge volume by mechanical dewatering

To evaluate sludge volume reduction alternatives, the plant must first define its present and future disposal cost factors. Typically, disposal sites accepting metal hydroxide sludge base their charges on the volume of sludge. In some cases, the site will have one rate structure for liquid sludges and one for nonflowing sludges. As a rule, the hauling cost is directly related to the sludge volume or weight.

Effects of Pollutant and Wastewater Load Reduction

Reduction of pollutant and wastewater loading on the waste treatment system will have the added benefit of reducing sludge volume. This reduction is part of the three-pronged benefit of implementing recovery and recycle techniques. For plants in areas where sludge disposal is expensive, the cost effectiveness of modifications to reduce water use or pollutant loading will be enhanced.

Although the effect of reducing wastewater flow is not usually as great as the effect of reducing the level of heavy metal pollutants in the wastewater, the volume of wastewater processed does influence sludge generation. The water volume treated, because of the high pH of most wastewater discharges, affects the consumption rate of the alkali neutralizing agent (caustic, lime) and water

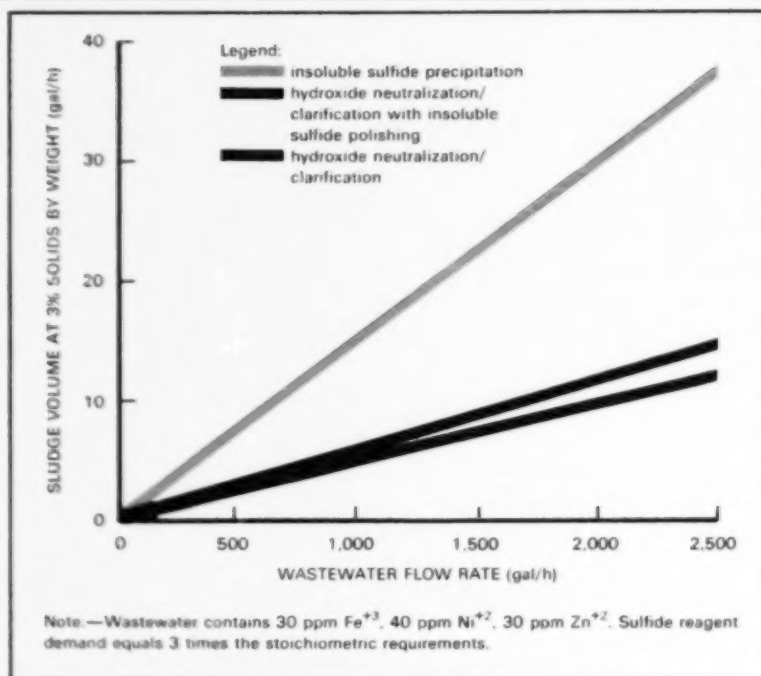


Figure 12.

Sludge Generation Rates for Three Treatment Systems

conditioning agents (ferric chloride, aluminum chloride), which are frequently fed at a rate dependent on the wastewater flow rate. These chemicals frequently contribute to the quantity of sludge generated. In the case of lime, some part normally remains insoluble and adds to the sludge volume. Conditioners such as ferric and aluminum chloride are converted to insoluble hydroxides during treatment and end up in the sludge.

The effect on sludge volume attributed to reducing plating chemical loss is easier to determine than the effect of wastewater flow. As an example, discharges of 1 lb (0.45 kg) of chromic acid anhydride to the wastewater will result in the precipitation of

approximately 1 lb (0.45 kg) of chromium hydroxide in the pH adjustment operations. This amount of chromium hydroxide will add approximately 6 gal (23 l) of volume to the clarifier underflow, based on an underflow solids concentration of 2 percent by weight. Similar relationships exist for the other metals used in plating operations.

Effects of Treatment Techniques

Because of the high cost of electroplating sludge disposal, the treatability studies conducted during the evaluation of the different treatment alternatives should address sludge generation factors and the dewatering properties of the resultant sludge.

Many of the newly developed treatment techniques marketed today offer improved pollutant

removal capabilities compared with the capabilities of conventional treatment, but they also result in significantly more sludge for disposal. For example, insoluble sulfide precipitation can reduce the metal concentration in many waste streams to lower levels than can hydroxide precipitation. ISP uses ferrous sulfide as the source of the sulfide ion. The ferrous ions liberated as a result of precipitating the metals as sulfides are then converted to ferrous hydroxide and add to the sludge volume.

Figure 12 compares the sludge generation rates of an insoluble sulfide precipitation system and an insoluble sulfide polishing system with a conventional hydroxide system using sodium hydroxide as the neutralizing agent, over a range of flow rates. Using the sulfide process as a polishing system to reduce the concentration of metals in the effluent after a conventional hydroxide precipitation/clarification sequence will achieve the same degree of metal removal as sulfide precipitation, but compared with the hydroxide process, will increase the volume of sludge generated only slightly. The trade-off, however, is that a polishing system will require additional hardware and have a higher initial cost. The saving in sludge disposal fees and reagent cost must justify the added expense if the polishing system is to be chosen.

Within an existing treatment process, the choice of reagents can affect sludge quantities generated. Lime and caustic soda are the two alkali neutralizing agents used most frequently. The advantages of lime include lower cost per unit of neutralizing capacity, sludge that settles and dewateres more readily, and the ability to reduce metals to lower levels in some applications (primarily because of the complex-

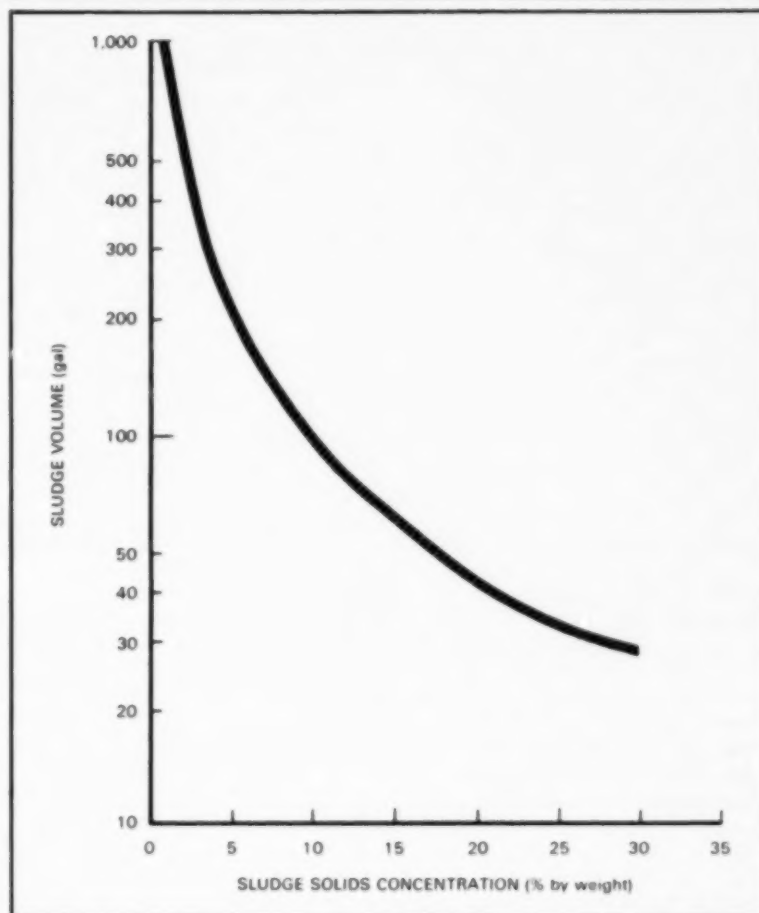


Figure 13.
Sludge Volume Versus Solids Concentration

breaking capabilities of the calcium ions). Lime has disadvantages, however, in that it requires a higher investment in the reagent feed system, takes longer to react in the wastewater, and (according to one study) produces three to six times the bulk of sludge produced by caustic soda neutralization. An effective analysis will identify the relative merits of the different reagents to be used.

Effects of Sludge Dewatering

Although sludge generation rates can be reduced significantly by the methods outlined earlier, some residue will always result from wastewater treatment. The cost to dispose of this residue will primarily depend on the sludge volume. The volume of dilute sludge withdrawn from the clarifier underflow can be reduced significantly through mechanical dewatering techniques. Figure 13

shows the volume reduction that can be achieved by dewatering clarifier underflows to different concentration levels.

Mechanical dewatering devices that have been used successfully to concentrate metal hydroxide sludge include vacuum, pressure, and compression filters and centrifuges.

Vacuum filters dewater sludge by applying a vacuum on one side of a water-permeable membrane, which has a sludge layer or suspension on the other side. In response to the pressure gradient, the water passes through the membrane. Rotary-drum and vacuum-belt filter methods employ this principle. Vacuum filters perform best with feed solids concentrations above 3 percent by weight; sludge containing lower feed solids concentrations should be thickened before vacuum filtration. Good filtration rates and trouble-free cake release from the filter media usually are realized with a sludge that is not too sticky or too compressible. Precoat rotary vacuum filtration can be used for dilute or otherwise hard-to-filter sludges. The precoat material represents an additional cost and adds to the quantity of solids for disposal, but precoat filtration often yields a higher solids concentration than conventional vacuum filtration.

Pressure filters pressurize the sludge and bring it in contact with a water-permeable membrane. Recessed plate filter presses use this method to dewater sludge. They can achieve high solids content because of the large pressure gradient they can apply across the sludge cake. Commercial units are designed that have operating pressure limits as high as 225 lb/in² gauge (1,654 kPa). As do vacuum filters, filter presses work best with sludges that have good filtration characteristics and are not too sticky or too compressible. Filter presses are effective in

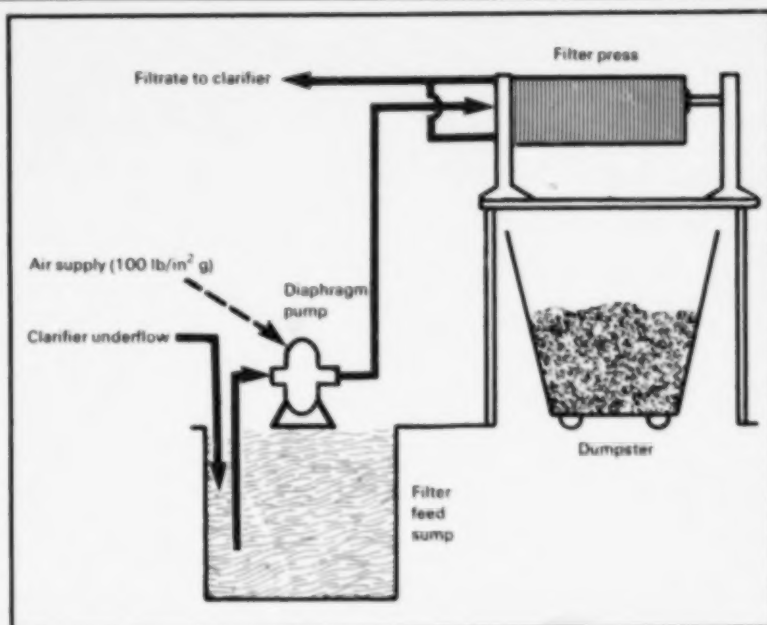


Figure 14.

Recessed Plate Filter Press and Auxiliary Equipment Needed for Sludge Dewatering

dewatering feed streams that are very dilute or subject to wide variations in feed solid concentration. For small applications, filter presses usually represent the least capital investment for sludge dewatering.

Compression filters dewater the sludge by squeezing it between water-permeable membranes. They have been proven effective mainly for dewatering highly compressible sludges characterized by large, delicate particle flocs typically associated with polyelectrolyte conditioning. The compression filter was developed to provide a device that overcomes the difficulty of applying filtration techniques to dewater this type of sludge. The filters are produced by a number of manufacturers and consist of a series of belts and rollers that gradually increase the compressive

force applied to the sludge cake. Compression filters consume less energy than vacuum filters or centrifuges, but are more sophisticated mechanically. Consequently, the relatively high cost of the smaller units makes them unattractive for concentrating the lower sludge volumes typical of the plating industry.

Centrifuges dewater sludge in a manner similar to gravity thickeners, but they create an apparent gravity thousands of times more powerful than normal by rapidly rotating the sludge. The increased gravity greatly accelerates the settling process and magnifies the compaction effect. This dewatering mechanism makes centrifuges most suitable for compressible sludges, which settle well. Use of the units usually necessitates conditioning of the feed stream with a polyelectrolyte to increase

settling ability. Basket centrifuges are used most frequently for electroplating sludge dewatering. They are attractive because of their compact size and automated operation.

Plants use dewatering devices for one of two reasons:

- To make sludge suitable for disposal at a local site that will only accept nonflowing sludges
- To achieve a net reduction in sludge disposal costs despite the operating cost associated with the dewatering equipment

The high cost of sludge disposal will justify dewatering equipment for all but generators of very small sludge volumes.

Consider, for example, the installation of a recessed plate filter (Figure 14) to dewater a dilute clarifier underflow from 3 percent solids by weight to 20 percent solids by weight. Figure 15 compares the

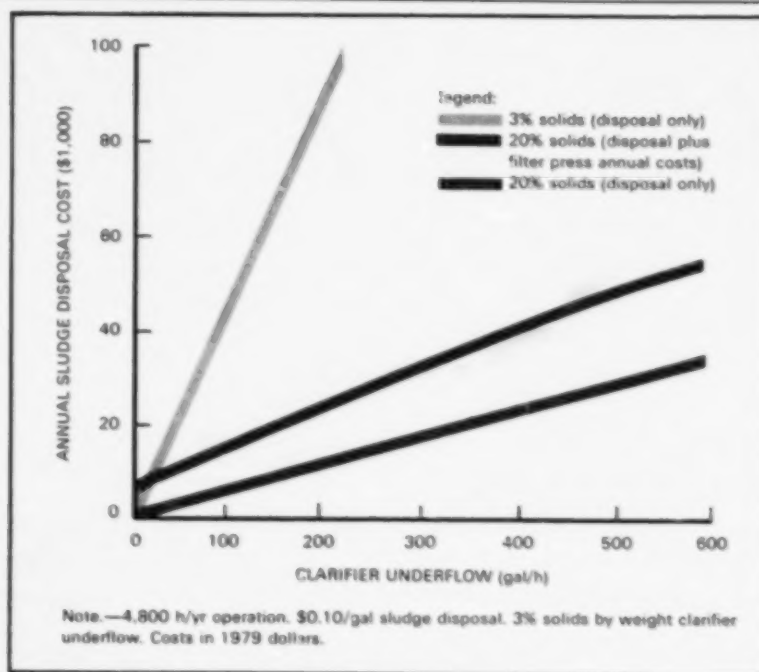
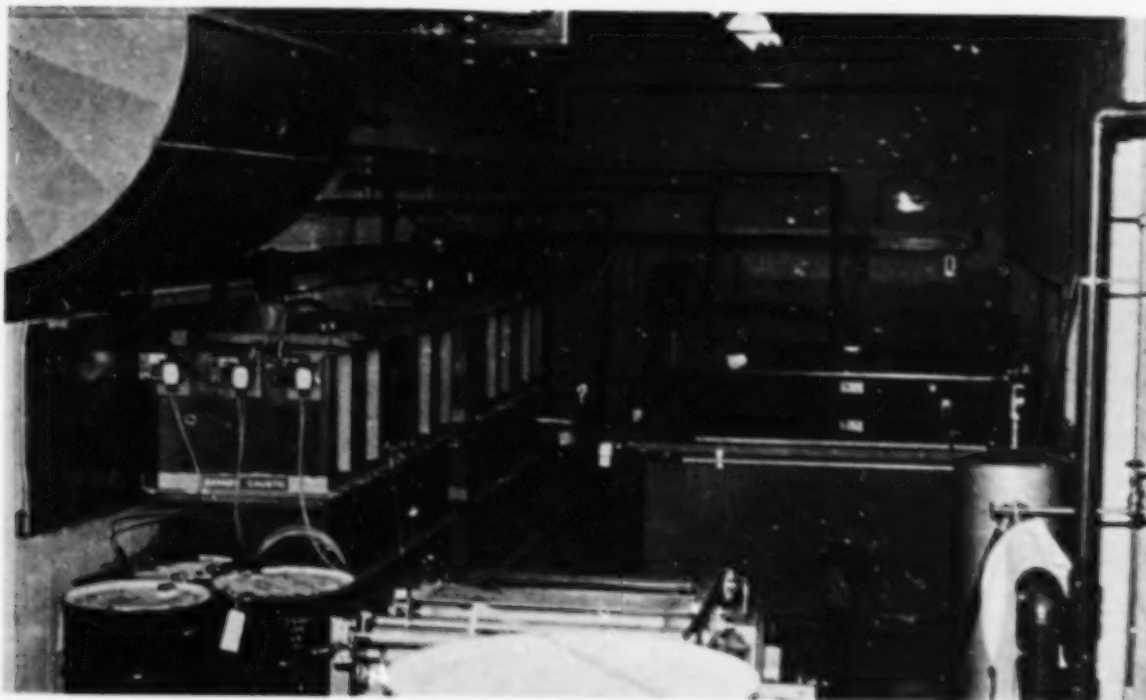


Figure 15.

Annual Sludge Disposal Cost for Filter Press Dewatering System



Single-stage cyanide oxidation, neutralization-flocculation, and settling tank with automatic sludge collector

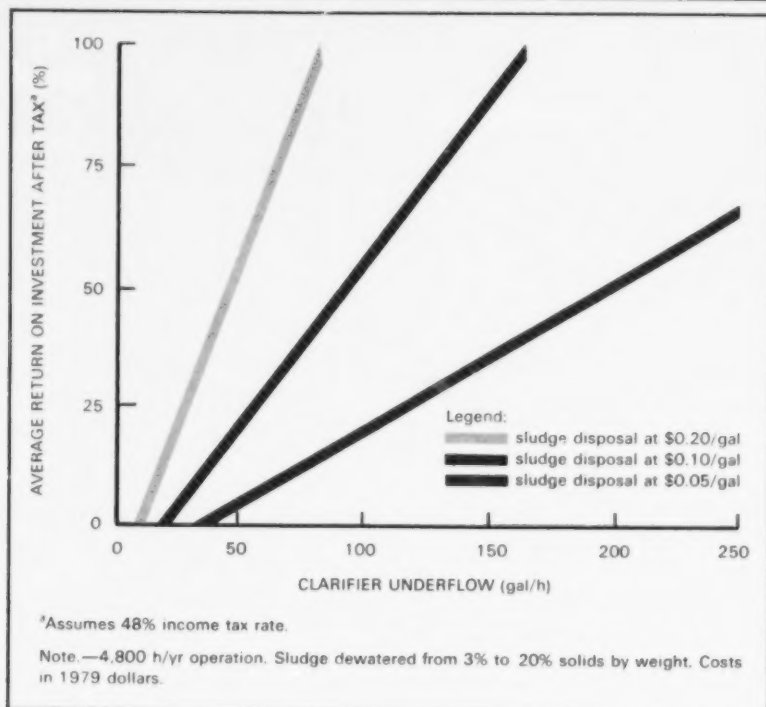


Figure 16.

Return on Investment From Recessed Plate Filter Installation

annual costs of sludge disposal, at \$0.10/gal of sludge, for the two concentrations. The figure

shows two curves for sludge disposal at 20 percent solids by weight: cost including filter press operation plus dewatered sludge disposal and cost for sludge

disposal alone. Even with its costs included, the filter press reduces annual disposal costs at underflow rates exceeding 15 gal/h (57 l/h). Figure 16 shows the return on investment resulting from installation of a filter press as a function of clarifier underflow rate over a range of sludge disposal costs. For a plant disposing of its sludge at \$0.10/gal, the investment has a reasonable rate of return at 50 gal/h (190 l/h). For a plant incurring a disposal cost of \$0.25/gal, the installation of a filter press would be favorable above 25 gal/h (95 l/h).

Thus, mechanical dewatering is usually cost effective, except for plants generating very small sludge volumes—less than 50 gal/h (190 l/h). RCRA will probably require that sludges be dewatered before land application. The facility that accepts the wastes, therefore, will be likely to have some means of dewatering dilute sludge. Plants generating small sludge volumes may find it most cost effective to use the dewatering capabilities of a central disposal site.

6. Financing Alternatives

The Federal Government has established tax incentives and has made financing alternatives available to ease the burden of compliance with environmental regulations.

Income Tax Provisions

Two available tax treatments permit a company to pay lower income taxes. The first alternative is the investment tax credit (ITC), a direct credit against current income taxes. Under this alternative, the company is allowed to take an ITC of 10 percent but cannot exceed the total tax liability, or \$25,000 plus 50 percent of the tax liability in excess of \$25,000, whichever is less. Any depreciation schedule approved by the Internal Revenue Service can be used in conjunction with the ITC; however, the equipment must be depreciable and have a life expectancy of at least 3 years. Questions on other applicable restrictions can be directed to the contacts listed in Section 8.

The second tax alternative involves special rapid amortization of pollution control facilities. It applies to facilities for water or atmospheric pollution control or abatement that were in operation before January 1, 1969, and that conform to applicable State and Federal regulations. Relatively new plants in operation before 1976 can rapidly amortize only a part of the investment. The rapid amortization provision allows a company to depreciate the total investment costs over a 60-month period; however, the useful life of the equipment cannot be greater than 15 years. With this tax alternative, half of the ITC, or 5 percent, also can be claimed against taxes, if the equipment has a useful life of at least 5 years.

Small Business Administration Loans

Various Federal financial assistance programs exist to help small businesses with pollution control costs. These loans come under the Small Business Administration (SBA) Economic Injury Loan Program and are intended for companies likely to suffer economic injuries without them. Loans have averaged \$125,000; roughly 25 percent have gone to electroplaters to date. The loans offer an attractive interest rate of 7½ percent and may extend for up to 30 years. Participating and guaranteed loans are available with SBA and commercial lending institutions, but higher interest rates apply.

To be eligible for an SBA loan, a company must be an existing small business and meet several other requirements. For example, the firm must have been turned down by a bank. The rejection may be made in any of a number of ways, for example, setting too high an interest rate or too short a payback period. The firm also must receive certification from EPA that the equipment is necessary and adequate, and it must demonstrate that regulatory requirements will cause serious economic injury.

SBA-Guaranteed Pollution Control Revenue Bonds

Revenue bond financing is used extensively by large businesses to supply funds for pollution control facilities. SBA-guaranteed bonds are issued to obtain the most advantageous interest rate and repayment terms possible for small businesses. The small business using this alternative applies

for a loan from a State or local authority having the right to issue bonds. SBA guarantees payment and the State then issues the bonds through an underwriter. The State or local authority becomes the nominal owner of the property, which can be conveyed to the business under a lease or under a lease-purchase agreement. Many of the requirements for this form of funding are similar to those for SBA loans.

Other Sources

Other, less direct forms of funding are available for financing pollution control facilities.

The Economic Development Administration (EDA) finances the growth of business in redevelopment areas. EDA loans, however, are typically large (they averaged \$1.5 million in 1977) and are oriented toward large businesses not covered by SBA programs. Although not specifically covered by EDA, pollution control equipment may be eligible for this financing in certain circumstances.

EDA also has funding available to assist States and local areas threatened with economic displacement because of such matters as environmental requirements placed on local industry. With this EDA funding, the State or local municipality owns the treatment facility and leases it to a group of industrial users. This centralized

treatment concept is expected to be heavily funded in the near future and is particularly applicable to electroplaters.

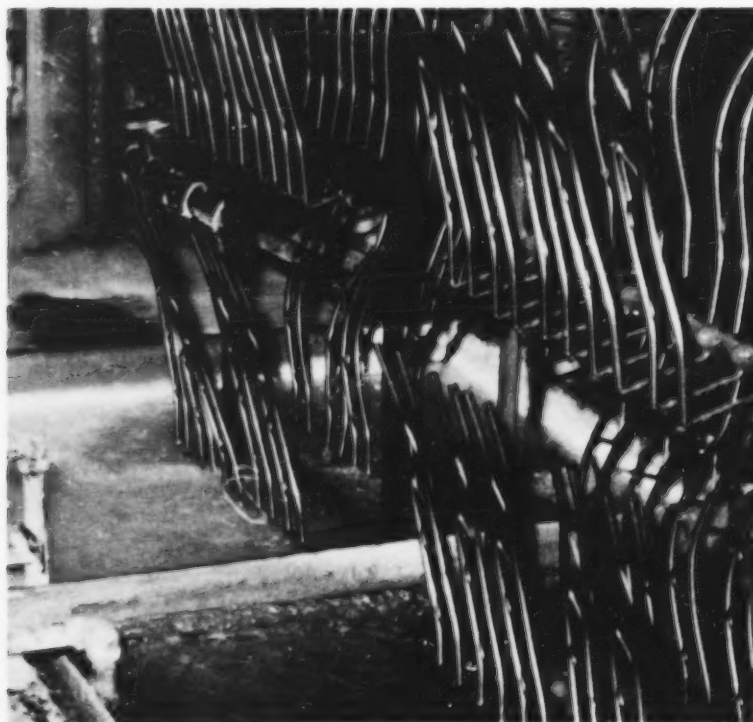
The Farmers Home Administration (FmHA) is authorized to provide business and industry loans to rural areas; however, the financing of pollution control equipment represents only a small part of the loan program. As a rule, FmHA encourages borrowers of less than \$400,000 to use the SBA.

7. Consolidated Permit Program

EPA has consolidated its permit programs, wherever feasible, to eliminate gaps and overlaps among the programs, to ensure consistency of regulatory approaches, and to provide uniform procedures to the regulated community. The permit application procedures were published in May 1980,³⁸ and include the following five programs:

- The Hazardous Waste Management programs under RCRA
- The Underground Injection Control program under the Safe Drinking Water Act
- The National Pollutant Discharge Elimination System under the Clean Water Act
- The Dredge or Fill program under the Clean Water Act, as this program is operated by States with approval by EPA
- The Prevention of Significant Deterioration (PSD) program under the Clean Air Act, where this program is operated by EPA (procedures not applicable to State-issued PSD permits)

The first and third programs are of most interest to electroplaters; however, the same basic application form can be used for permits under any of the programs. The consolidated form collects general information that applies to all programs; this form is supplemented by a form unique to the specific program. Although there are exclusions under each program, heavy penalties are imposed for failure to apply for a permit when one is required. The appropriate EPA Regional Office can determine whether a permit is required in a given situation. The consolidation effort is limited because some programs are operated by the State rather than by the EPA Regional Offices. One permit may be required by the State and another by EPA. The appropriate Regional Office can supply information about where to apply.



Cationic rinse tanks

8. Contacts

A number of local and Federal representatives may be consulted on matters related to regulations or financial assistance. These contacts are listed in the paragraphs that follow, with details of how they can be reached. It should be borne in mind that names of persons are current and subject to change. Addresses and telephone numbers, however, will remain valid.

Regulatory Information

All contacts for regulatory information should be addressed at:

U.S. Environmental Protection Agency
401 M Street, S.W.
Washington DC 20460

Names of persons to be consulted on a given subject area appear with the appropriate office numbers and are followed by the telephone numbers at which they can be reached.

Water

Requests for information on water regulations should be addressed to:

Jeffrey D. Denit (WH-552)
(202) 426-2576

Solid Wastes

The appropriate contact for solid waste regulatory information will depend on the subject area.

*Hazardous Waste Criteria—
Identification and Listing*
Alan Corson (WH-565)
(202) 755-9187

*Standards for Generators of
Hazardous Wastes*
Harry Trask (WH-563)
(202) 755-9150

*Standards for Transporters of
Hazardous Wastes*
Harry Trask (WH-563)
(202) 755-9150

Standards for Treatment of Hazardous Wastes

Steve Lingle (WH-565)
(202) 755-9200

Permit Regulations for Hazardous Waste Treatment, Storage, and Disposal

Arthur Glazer (WH-563)
(202) 755-9150

Guidelines for State Hazardous Waste Programs

Dan Derkics (WH-563)
(202) 755-9150

Financial Assistance Information

EPA Headquarters

For general information on financial assistance, the contact is:

Frances Desselle
Financial Assistance Coordinator
Office of Analysis and Evaluation
Environmental Protection Agency
Room 745 E.T. (WH-586)
401 M Street, S.W.
Washington DC 20460

The telephone number for this contact is: (202) 426-7874.

Farmers Home Administration

Questions relating to FmHA business and industry loans for rural areas should be directed to:

U.S. Department of Agriculture
Room 5314
14th St. and Independence Ave., S.W.
Washington DC 20250

Small Business Administration

Information on SBA-guaranteed bonds can be obtained from:

Earl L. Chambers
Director
Office of Special Guarantees
Small Business Administration
1441 L Street, N.W.
Washington DC 20416

This office can be reached by telephone at: (202) 235-2900.

Economic Development Administration

Information on the various kinds of EDA funding can be obtained from:

Daryl Bladen
Deputy Director of Public Works
or
Joseph Rosenblum
(202) 377-5265

EPA Regional Offices

Addresses are given in the following paragraphs for the 10 EPA regions. Hours of operation are also included, as well as the names and telephone numbers of regional administrators and financial assistance officers.

Region I

The region is composed of Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont.

Administrator
William R. Adams, Jr.
(617) 223-7210

Financial Assistance Coordinator
Ted Landry
Enforcement Division
(617) 223-5061

Address
Room 2203
J.F.K. Federal Building
Boston MA 02203

Hours
8 a.m. to 5 p.m.

Region II

The region is composed of New Jersey, New York, Puerto Rico, and the Virgin Islands.

Administrator
Charles S. Warren
(212) 264-2525

Financial Assistance Coordinator
Gerald DeGaetano
Permits Administration Branch
Enforcement Division
(212) 264-4711

Address
Room 1009
26 Federal Plaza
New York NY 10007

Hours
8 a.m. to 4:30 p.m.

Region III

The region is composed of Delaware, Maryland, Pennsylvania, West Virginia, the District of Columbia, and Virginia.

Administrator
Jack Schramm
(215) 597-9814

Financial Assistance Coordinator
Bob Gunter
FRC Liaison Officer
(215) 597-2763

Address
Curtis Building
Sixth and Walnut Sts.
Philadelphia PA 19106

Hours
8 a.m. to 4:30 p.m.

Region IV

The region is composed of Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, and Tennessee.

Administrator
Rebecca W. Hanmer
(404) 881-4727

Financial Assistance Coordinator
John Hurlebaus
Supervisor
Grants Analysis
Program Support Branch
Grants Administrative Support
Section
(404) 881-4491

Address
345 Courtland St., N.E.
Atlanta GA 30308

Hours
8:15 a.m. to 4:45 p.m.

Region V

The region is composed of Illinois, Indiana, Wisconsin, Michigan, Minnesota, and Ohio.

Administrator
John McGuire
(312) 353-2000

Financial Assistance Coordinator
Arnold Leder
Chief
Water Branch
(312) 353-2904

Address
230 S. Dearborn St.
Chicago IL 60604

Hours
8:15 a.m. to 4:45 p.m.

Region VI

The region is composed of Arkansas, Louisiana, New Mexico, Oklahoma, and Texas.

Administrator
Adelene Harrison
(214) 767-2600

Financial Assistance Coordinator

Jan Horn
Enforcement Division
(214) 729-2760

Address

First International Building
1201 Elm St.
Dallas TX 75270

Hours

8 a.m. to 4:30 p.m.

Region VII

The region is composed of
Kansas, Missouri, Nebraska, and
Iowa.

Administrator

Kathleen Q. Camin
(816) 374-5493

Financial Assistance Coordinator

Paul Walker
Chief
Engineering Branch
Water Division
(816) 374-2725

Address

1735 Baltimore St.
Kansas City MO 64108

Hours

7:15 a.m. to 4 p.m.

Region VIII

The region is composed of
Colorado, Wyoming, Montana,
North Dakota, South Dakota, and
Utah.

Administrator

Roger L. Williams
(303) 837-3895

Financial Assistance Coordinator

Gerald Burke
Office of Grants
Water Division
(303) 327-4579

Address

1860 Lincoln St.
Denver CO 80203

Hours

8 a.m. to 4:30 p.m.

Region IX

The region is composed of
Arizona, California, Hawaii, Nevada,
American Samoa, Guam, and the
Trust Territories.

Administrator

Paul de Falco, Jr.
(415) 556-2320

Financial Assistance Coordinator

Linda Powell
Permits Branch
Enforcement Division
(415) 556-3450

Address

215 Fremont St.
San Francisco CA 94105

Hours

8 a.m. to 4:30 p.m.

Region X

The region is composed of
Alaska, Idaho, Oregon, and
Washington.

Administrator

Donald P. Dubois
(206) 442-1220

Financial Assistance Coordinator

Dan Bodien
Special Technical Advisor
Enforcement Division
(206) 442-1352

Address

1200 Sixth Ave.
Seattle WA 98101

Hours

8 a.m. to 4:30 p.m.

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This industrial awareness report was prepared by the Centec Corporation, Fort Lauderdale FL and Reston VA. EPA thanks the following organizations for providing information and technical review: American Electroplaters' Society; Gillette Company, Safety Razor Division, Boston MA; Holly Carburetor, a Division of Colt Industries, Paris TN; Hurd Lock and Manufacturing Company, Greensville TN; Medford Plastics Company, Medford WI; and Phillips Plating Company, Phillips WI. Aqualogic® Inc., Bethany CT, provided photographs.

This report has been reviewed by the U.S. Environmental Protection Agency and approved for publication. The process alternatives, trade names, or commercial products are only examples and are not endorsed or recommended by the U.S. Environmental Protection Agency. Other alternatives may exist or may be developed that are applicable to the electroplating industry.

COVER PHOTOGRAPH: Nickel plating bath.

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